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PROCEEDINGS

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LIST OF GRANTS MADE FROM THE RESEARCH FUND DURING THE YEAR 1909.

£6 to A. J. Allmand: electromotive properties of the oxides of mercury, and the investigation of some organic gaseous equilibria.

£7 to R. Alpern: condensation of glycerol and its chlorohydrins with various amido-acids.

£8 to D. Bain: synthesis of narcotine.

£15 to E. C. C. Baly: ultra-violet absorption spectra of organic compounds (continued).

£10 to G. Barger: adsorption of iodine.

£5 to T. V. Barker: the regular growth of crystals on each other.

£5 to A. Clayton: preparation and constitution of coumarinic acid (continued).

£9 to Miss M. E. Dobson: attempt to synthesise berberine.

£9 to J. C. Duff: condensations of aromatic aldehydes with homophthalic acids.

£5 to J. A. N. Friend: corrosion of iron at various temperatures (continued).

£8 to H. D. Gardner: resolution of *cyclo*butane and *cyclo*pentane dicarboxylic acids into their optically active modifications.

£15 to C. Gilling: hydroaromatic ketones (continued).

£10 to G. S. Hibbert: reduction of hydroxy-*o*-toluic acid.

£10 to H. Hibbert: affinity of organic compounds, and the constitution of ammonium salts.

£10 to A. Holt, jun.: action of the silent electric discharge upon carbon dioxide and oxygen.

£7 to E. Hope: ethyl benzoylacetate.

£8 to E. Hope: condensation products from cotarnine and benzoylcotarnine.

£7 to J. Lister: attempt to synthesise cotarnic acid.

£7 to T. M. Lowry: dynamic isomerism (continued).

£5 to H. McCombie: action of dehydrating agents on cyanohydrins.

£6 to P. May: studies in the diphenyl series.

£10 to A. N. Meldrum: reduction of hydroxy-*m*-toluic acid (continued).

£15 to W. H. Mills: investigation of optically active compounds.

£8 to G. T. Morgan: organic derivatives of antimony and allied elements.

£5 to G. T. Morgan: influence of substitution on the tinctorial properties of azo-dyes and allied colouring matters (continued).

£6 to W. Parry: action of Grignard's reagents on the esters of hydroxy*iso*butyric, diethyloxalic, and benzilic acids.

£10 to A. G. Perkin: constitution of carthamine.

£17 to R. H. Pickard: isomeric menthols (continued).

£15 to R. Robinson: synthesis of papaverine; and investigation of pyranol salts (continued).

£5 to G. Senter: reactivity of halogens in organic compounds.

£15 to J. L. Simonsen: formation and properties of the *cyclo*butane ring. Attempt to synthesise norpinic acid, and the constitution of the aloins (continued).

£15 to Miss I. Smedley: refractive indices of unsaturated compounds (continued).

£10 1. 8. to S. Smiles: quadrivalent sulphur.

£5 to Clarence Smith: constitution of the hydroxyazo-compounds (continued).

£5 to J. A. Smythe: organic polysulphides.

£10 to R. Storey: resolution of methyltetrahydrobenzoic acid into its optically active modifications (continued).

£6 to R. Storey: conversion of cyclic unsymmetrical imides into *n*-substituted derivatives.

£5 2. 7. to J. J. Sudborough: esterification and hydrolysis of esters (continued).

£2 to D. Thomson: condensation of active methyl*cyclo*hexanone-3 with various aldehydes.

£15 to J. F. Thorpe: transformation of aliphatic dinitriles into alicyclic imino-nitriles.

£8 to C. K. Tinkler: action of bases and of potassium cyanide on alkyl and aryl salts of cyclic bases.

£5 to W. E. S. Turner: molecular complexity of amides, amines, and nitriles in the liquid state.

£5 to W. E. S. Turner and C. J. Peddle: the hydroxyl group as a cause of molecular association.

Total amount granted during 1909 = £369. 4. 3.

LIST OF FELLOWS ELECTED DURING 1909.

Name.	Proposed.	Elected.
Adlam, George Henry Joseph	December 17th, 1908.	February 18th.
Aiyer, A. K. Yegna Narayan	June 17th, 1909	December 2nd.
Anklesaria, Jehangir Dhanjishaw	October 21st, 1909	,, ,,
Annett, Harold Edward	May 6th, 1909	June 17th.
Armstrong, James Alexander Hadden	October 21st, 1909	December 2nd.
Arnfield, Harold	May 6th, 1909	June 17th.
Barker, Donald William Elsom	October 21st, 1909	December 2nd.
Baron, Harold	,, ,,	,, ,,
Bennett, Hugh Garner	February 18th, 1909	May 6th.
Best, Stanley Robert	October 21st, 1909	December 2nd.
Blackburn, Albert Riley	March 18th, 1909	May 6th.
Bletcher, Henry Ernest John	,, ,, ,,	,, ,,
Bottomley, Hubert Frederick	October 21st, 1909	December 2nd.
Breakspear, Henry Shaw	,, ,, ,,	,, ,,
Brunskill, Hubert	December 17th, 1908.	February 18th.
Burger, O. K. H.	October 21st, 1909	December 2nd.
Burt, Frank Playfair	February 18th, 1909	May 6th.
Bury, Frank Ward	October 21st, 1909	December 2nd.
Callister, William Edward	October 21st, 1909	December 2nd.
Campbell, Walter	March 18th, 1909	May 6th.
Carey, William Gordon	October 21st, 1909	December 2nd.
Caulkin, Howard Alfred	February 4th, 1909	May 6th.
Chambliss, Hardee	June 3rd, 1909	December 2nd.
Chand, Lakshami	October 21st, 1909	,, ,,
Chew, John Henry	February 4th, 1909	May 6th.
Clarke, George	,, ,, ,,	,, ,,
Clayton, Arthur	November 19th, 1908.	February 18th.
Cocksedge, Herbert Edwin	December 3rd, 1908	,, ,,
Coles, Alfred Bertram	January 21st, 1909	,, ,,
Cooke, Reginald Cyril Herbert	February 18th, 1909.	May 6th.
Coope, John Charles Jesser	November 19th, 1908.	February 18th.
Cooper, George Stanley	February 4th, 1909	May 6th.
Couch, Daniel Little	March 18th, 1909	,, ,,
Couzens, Edward Gordon	,, ,, ,,	,, ,,
Creighton, Henry Jermain Maude	February 18th, 1909.	,, ,,
Crewe, Philip Henry	,, ,, ,,	,, ,,
Dawson, James Ferguson	October 21st, 1909	December 2nd.
Dunlop, John Gunning Moore	May 20th, 1909	June 17th.
Dunn, Frederick Percy	December 3rd, 1908	February 18th.
Dunningham, Alfred Charles	October 21st, 1909	December 2nd.
Dyche-Teague, Francis Clifford	March 18th, 1909	May 6th.
Edgar, Edward Charles	October 21st, 1909	December 2nd.
Edge, Alfred	,, ,, ,,	,, ,,

Name.	Proposed.	Elected.
Edge, John Harold	April 1st, 1909	June 17th.
Edwards, Frederick Watson	October 21st, 1909	December 2nd.
Egerton, Alfred Charles Glyn	May 6th, 1909	June 17th.
Essex, Harry, jun.	,, ,, ,,	,, ,,
Ewins, Arthur James	October 21st, 1909	December 2nd.
Ferraboschi, Frederic	December 3rd, 1908	February 18th.
Flack, Edmund Victor	November 18th, 1909	December 2nd.
Forrester, George Peters	October 21st, 1909	,, ,,
Forshaw, Arthur	November 4th, 1909	,, ,,
Fowler, William	February 4th, 1909	May 6th.
Fox, John Thomas	January 21st, 1909	February 18th.
Francis, Arthur Gordon	November 19th, 1908	,, ,,
Freymuth, William Adolf	October 21st, 1909	December 2nd.
Fürstenhagen, Otto	,, ,, ,,	,, ,,
Furneaux, George Pomeroy	,, ,, ,,	,, ,,
Furnell, John Thomas	January 21st, 1909	February 18th.
Gardiner, Alexander David	November 4th, 1909	December 2nd.
Gardner, Henry Dent, jun.	October 21st, 1909	,, ,,
Gortner, Ross Aiken	November 19th, 1908	February 18th.
Green, John Wilberforce	December 17th, 1908	,, ,,
Grist, Charles James	March 18th, 1909	May 6th.
Gwyer, Alfred George Cooper	January 21st, 1909	February 18th.
Harding, Victor John	October 21st, 1909	December 2nd.
Hargreaves, Egerton	February 4th, 1909	May 6th.
Harland, Robert Main	January 21st, 1909	February 18th.
Harvey, Arthur John	October 21st, 1909	December 2nd.
Haworth, Walter Norman	December 3rd, 1908	February 18th.
Haws, John Frederick	February 18th, 1909	May 6th.
Hayward, Eric	December 3rd, 1908	February 18th.
Hendry, Robert Douglas	October 21st, 1909	December 2nd.
Hibbert, Harold	April 1st, 1909	June 17th.
Hickinbotham, Reginald Vernon	February 18th, 1909	May 6th.
Higson, Frank	November 19th, 1908	February 18th.
Holmyard, Eric John	,, 4th, 1909	December 2nd.
Hopkinson, Reginald	February 4th, 1909	May 6th.
Hoseason, James Henry	November 19th, 1908	February 18th.
Hough, Ralph	,, ,, ,,	,, ,,
Jackson, Robert Ernest	December 3rd, 1908	February 18th.
Jeffery, John Hugh	,, ,, ,,	,, ,,
Jones, Henry Humphreys	January 21st, 1909	,, ,,
Keeble, Horace	January 21st, 1909	February 18th.
Kirby, Oswald Farquhar	May 20th, 1909	June 17th.
Lakhani, Hassum A.	June 3rd, 1909	June 17th.
Leech, Benjamin	June 17th, 1909	December 2nd.
Leedham, Joseph	January 21st, 1909	February 18th.
Levy, Leonard Angelo	March 18th, 1909	May 6th.
Lewis, William Cudmore McCullagh	October 21st, 1909	December 2nd.
Livsey, Harry	March 4th, 1909	May 6th.
Lundholm, Carl Olof	October 21st, 1909	December 2nd.

Name.	Proposed.	Elected.
McGillvray, John Esson	December 17th, 1908.	February 18th.
Martin, William George	January 21st, 1909	,, ,,
Matchet, Andrew Sneddon	May 6th, 1909	June 17th.
May, Percy	November 19th, 1909	February 18th.
May, Roland Josiah	April 1st, 1909	June 17th.
Metzger, Floyd Jay	February 4th, 1909	May 6th.
Morley, William Norton	December 17th, 1908	February 18th.
Müller, Robert	March 18th, 1909	May 6th.
Muller, John	November 18th, 1909.	December 2nd.
Napier, Thomas	April 1st, 1909	June 17th.
Norris, Roland Victor	October 21st, 1909	December 2nd.
Okell, Frederick Leigh	March 18th, 1909	May 6th.
Owen, Robert Cecil	March 4th, 1909	,, ,,
Painter, Frederick Hubert	December 17th, 1908.	February 18th.
Peixoto, Joãs Cornelio Rodrigues	November 18th, 1909	December 2nd.
Pickard, Joseph Allen	December 3rd, 1908	February 18th.
Picton, Norman	May 6th, 1909	June 17th.
Ping, Francis Hugh	November 4th, 1909	December 2nd.
Pope, Frank George	November 19th, 1908	February 18th.
Proud, Charles	October 21st, 1909	December 2nd.
Regan, Colston James	December 17th, 1908.	February 18th.
Resker, Herbert Charles	May 6th, 1909	June 17th.
Ritchings, Walter	October 21st, 1909.	December 2nd.
Robinson, Fred.	May 21st, 1909	June 17th.
Robinson, Frederic William	June 17th, 1909	December 2nd.
Robinson, Robert	January 21st, 1909	February 18th.
Rogers, Herbert	,, ,, ,,	,, ,,
Rudolf, Norman Scott	March 4th, 1909	May 6th.
Sabherwal, Pindi Das	October 21st, 1909	December 2nd.
Sageman, Philip John	November 19th, 1908.	February 18th.
Sawbridge, Barth. Frere	May 6th, 1909	June 17th.
Schulten, J. H. Charles	January 21st, 1909	February 18th.
Segaller, David	December 3rd, 1908	,, ,,
Sinha, Manindra	October 21st, 1909	December 2nd.
Smith, Henry Llewellyn	March 4th, 1909	May 6th.
Stanford, Spencer Boyd Cortis-	October 21st, 1909	December 2nd.
Stephenson, Guy	,, ,, ,,	,, ,,
Stevenson, James Thomas	December 17th, 1908.	February 18th.
Stones, George Bertram	October 21st, 1909	December 2nd.
Strachan, James Thallon	,, ,, ,,	,, ,,
Strohmenger, Arthur Percy	March 4th, 1909	May 6th.
Taplin, Edward Walter	June 3rd, 1909	December 2nd.
Tapp, Charles	November 18th, 1909	,, ,,
Tate, Arthur Edwin	February 18th, 1909	May 6th.
Thomas, Oswald John Dalgatty	February 4th, 1909	,, ,,
Thoms, Hermann	June 17th, 1909	December 2nd.
Tilley, Vernon James	February 4th, 1909	May 6th.
Tingle, Joseph Grantley	October 21st, 1909	December 2nd.
Tizard, Henry Thomas	,, ,, ,,	,, ,,
Truelove, Charles William	February 4th, 1909	May 6th.
Turner, Herbert	October 21st, 1909	December 2nd.

Name.	Proposed.	Elected.
Usher, Francis Lawry	February 18th, 1909	May 6th.
Van Essen, Everard Cecil	June 17th, 1909	December 2nd.
Varley, Reginald Wells	December 3rd, 1908	February 18th.
Waliaschko Nikolai	October 21st, 1909	December 2nd.
Walker, George Bilderbeck	March 4th, 1909	May 6th.
Warwick, Guy Ransom	January 21st, 1909	February 18th.
Webster, John	March 18th, 1909	May 6th.
Weizmann, Charles	October 21st, 1909	December 2nd.
West, Percy Charles Henry	January 21st, 1909	February 18th.
Wheeler, Richard Vernon	November 4th, 1909.	December 2nd.
Wild, Thomas Jabez	January 21st, 1909	February 18th.
Williams, Herbert Ernest	October 21st, 1909	December 2nd.
Wills, Harry Sampson	May 6th, 1909	June 17th
Wilson, Robert William	February 4th, 1909	May 6th.
Woods, George James	May 6th, 1909	June 17th.
Wright, Joseph Pretty	November 18th, 1909.	December 2nd.
Young, Roland Francis	October 21st, 1909	December 2nd.

LIST OF FELLOWS DECEASED DURING 1909.

Name.	Elected.	Died.
Bannister, Richard	January 19th, 1871	September 27th, 1909.
Castell-Evans, John	February 18th, 1903	May 13th, 1909.
Cox, Ebenezer John	December 2nd, 1886	February 6th, 1909.
Ekin, Charles	December 1st, 1864	August 4th, 1909.
*Erlenmeyer, Emil	February 1st, 1883	January 22nd, 1909.
Fuller, John	December 2nd, 1886	May 17th, 1908.
Graham, Charles	May 1st, 1862	November 13th, 1909.
Harrison, Hugh Erat	June 21st, 1883	August 12th, 1909.
Hudleston, Wilfrid Hudleston	March 2nd, 1871	January 29th, 1909.
Johnson, Samuel Henry	May 10th, 1866	March 12th, 1909.
Kielty, John Joseph	December 3rd, 1903	June 13th, 1909.
Mond, Ludwig	February 15th, 1872	December 11th, 1909.
Norton, Fletcher	December 18th, 1854	April 12th, 1909.
Perry, George Edward	December 6th, 1888	July 21st, 1909.
Pontifex, Edmund Alfred	December 4th, 1848	October 12th, 1909.
Redwood, Theophilus Horne	March 17th, 1887	March 31st, 1909.
Roberts, William Brittain	February 19th, 1880	July 25th, 1909.
Russell, William James	March 3rd, 1851	November 12th, 1909
Stewart, Walter	June 20th, 1872	February 11th, 1909.
Stocks, Frederic	June 18th, 1874	May 31st, 1909.
Thomas, Charles	December 7th, 1871	September 30th, 1909.
Thomas, Harry Edgecumbe	March 5th, 1874	February 9th, 1909.
*Thomsen, Julius	May 18th, 1876	February 13th, 1909.
Wardle, Sir Thomas	May 20th, 1875	January 3rd, 1909.
Watson, Alexander Forbes	May 4th, 1893	August 4th, 1909.
Wilson, James Henry	May 16th, 1878	June 1st, 1909.

* Honorary and Foreign Member.

TITLES OF PAPERS COMMUNICATED TO THE SOCIETY DURING 1909.

	Page in Proceedings.	Page in Transactions.
January 21st.		
1. Organic derivatives of silicon. Part IX. Experiments on the resolution of *dl*-benzylethylpropyl*iso*butylsilicanesulphonic acid. By Frederic Stanley Kipping and Harold Davies	9	69
2. The crystallisation of externally compensated mixtures. By Frederic Stanley Kipping and William Jackson Pope	9	103
3. Formation of *cyclo*hexanone derivatives from olefinic compounds. By Siegfried Ruhemann	10	109
4. Synthesis of para-urazine from carbamide. By Frederick Daniel Chattaway	10	235
5. Chlorine derivatives of substituted carbamides. By Frederick Daniel Chattaway and Donald Frederick Sandys Wünsch	11	129
6. Chemical examination of Eriodictyon. Part II. By Frank Tutin and Hubert William Bentley Clewer	12	81
7. The hydration of precipitates. By Spencer U. Pickering	12	123
8. Studies of dynamic isomerism. Part VIII. The relationship between absorption spectra and isomeric change. Absorption spectra of halogen, nitro-, and methyl derivatives of camphor. By Thomas Martin Lowry and Cecil Henry Desch	13	807
9. The relationship between the constitution and the absorption spectra of pyridine and various derivatives. By John Edward Purvis	14	294
10. The action of mustard oils on the ethyl esters of malonic and cyanoacetic acids. Part II. By Siegfried Ruhemann	14	117
11. The interaction of hydrogen and chlorine. By David Leonard Chapman and Patrick Sarsfield MacMahon	15	135
12. Nitrogen chloride. By David Leonard Chapman and Leonard Vodden	15	138
13. The atmospheric oxidation of β-methylhydrindone. By Arthur Henry Salway and Frederic Stanley Kipping	16	166
14. A glucoside from Tephrosia purpurea. (Preliminary note.) By George Clarke, jun., and S. C. Banerjee	16	—
15. Note on the constitution of the carboxyl group. By Ida Smedley	16	231
16. The relation between the chemical constitution and optical properties of the aromatic α- and γ-diketones. By Ida Smedley	17	218

	Page in Proceedings.	Page in Transactions.
17. The transformation of aliphatic nitriles into alicyclic imino-compounds. (Preliminary note.) By Jocelyn Field Thorpe	17	—
18. Action of alcohols on metallic calcium. By Frederick Mollwo Perkin and Lionel Pratt	18	159
19. The condensation of oxymethylenecamphor with primary and secondary amino-compounds. By William Jackson Pope and John Read	18	171
20. Note on the variation in the catalytic activity of mineral acids with changes in their concentration. By Arthur Lapworth	19	—
21. The condensation of dimethyldihydroresorcin with ethylamine. By Paul Haas	19	421

February 4th.

	Page in Proceedings.	Page in Transactions.
22. The mechanism of the reduction of nitroanilines and nitrophenols. By Bernhard Flürscheim	21	—
23. The relation between the strength of acids and bases and the quantitative distribution of affinity in the molecule. By Bernhard Flürscheim	22	718
24. Note on the determination of the rate of chemical change by measurement of the gases evolved. By Francis Edward Everard Lamplough	23	—
25. The triazo-group. Part VII. Interaction of benzhydroximic chloride and sodium azide. By Martin Onslow Forster	25	184
26. The triazo-group. Part VIII. Azoimides of the monobasic aliphatic acids. By Martin Onslow Forster and Robert Müller	26	191
27. Nitro-derivatives of ortho-xylene. By Arthur William Crossley and Nora Renouf	26	202
28. The divergence of the atomic weights of the lighter elements from whole numbers. By Alfred Charles Glyn Egerton	26	238
29. The constituents of the bark of Prunus serotina. Isolation of *l*-mandelonitrile glucoside. By Frederick Belding Power and Charles Watson Moore	27	243
30. Benzyl and ethyl derivatives of silicon tetrachloride. By Geoffrey Martin and Frederic Stanley Kipping	27	302
31. The formation and reactions of imino-compounds. Part VIII. The formation of methyl derivatives of 2-phenyl-1 : 3-naphthylenediamine from the three tolylacetonitriles. By Stanley Robert Best and Jocelyn Field Thorpe	28	261
32. The effect of contiguous unsaturated groups on optical activity. Part I. By Thomas Percy Hilditch	29	331
33. The miscibility of solids. By Ernest Vanstone	30	590
34. Esterification constants of substituted acrylic acids. Part III. By John Joseph Sudborough and James Mylam Gittins	31	315

	Page in Proceedings.	Page in Transactions.
35. Brazilin, hæmatoxylin, and their derivatives. Part X. The constitution of trimethylbrazilone, of α- and β-anhydrotrimethylbrazilone, and of the corresponding derivatives of hæmatoxylin. By William Henry Perkin, jun., and Robert Robinson	31	381
36. The preparation of disulphides. Part III. The nitrobenzyl disulphides. (A correction.) By Thomas Slater Price and Douglas Frank Twiss	32	—
37. Derivatives of naphthacenequinone. Part III. By Dorothy Harrop, Roland Victor Norris, and Charles Weizmann	33	279
38. The nature of ammoniacal copper solutions. Part II. The solubility of cupric hydroxide in ammoniacal sulphate solutions. By Harry Medforth Dawson	33	370
39. The action of β-rays on photosensitive solutions. By Otto Flaschner	34	327
40. The rusting of iron. By Gerald Tattersall Moody	34	—
41. The iodobenzenemonosulphonic acids. Part I. By Mary Boyle	35	1683
42. Contributions to the chemistry of the terpenes. Part IV. The oxidation of pinene with mercuric acetate. By George Gerald Henderson and James Watson Agnew	35	289
43. Formation of heterocyclic compounds. Part I. 1-Phenylpyrrolidine-2 : 5-dicarboxylic acid from adipic acid. By Henry Rondel Le Sueur	36	273
44. The influence of solvents on the rotation of optically active compounds. Part XIV. Ethyl tartrate in benzaldehyde and in quinoline. By Thomas Stewart Patterson and David Paterson McDonald	36	321

February 18*th*.

	Page in Proceedings.	Page in Transactions.
45. A study of some asymmetric compounds. By Frederic Stanley Kipping	55	408
46. The decomposition and sublimation of ammonium nitrite. By Prafulla Chandra Rây	56	345
47. The estimation of hydroxyl derivatives in mixtures of organic compounds. By Harold Hibbert	57	—
48. A simple method for determining the chemical affinity of organic substances. By Harold Hibbert	57	—
49. Chlorine generated by potassium permanganate: its preparation and purity. By Edgar Wedekind and Samuel Judd Lewis	59	—
50. The isolation of the aromatic sulphinic acids. By John Thomas	60	342
51. Analytical investigation of zirconium metal. By Edgar Wedekind and Samuel Judd Lewis	60	456
52. The action of ethylene dibromide on monomethylaniline. By John Gunning Moore Dunlop and Humphrey Owen Jones	61	416

	Page in Proceedings.	Page in Transactions.
53. Salicylidene-*m*-toluidine, a new phototropic compound: salicylideneamines: salicylamides. By Alfred Senier and Frederick George Shepheard	61	441
54. The action of ethyl carbamate on esters of organic acids and mustard oils. By Siegfried Ruhemann and John Gillies Priestley	62	449
55. The hydrolysis of amygdalin by emulsin. Part III. Synthesis of *d*-benzaldehydecyanohydrin. By Samuel James Manson Auld	62	927
March 4th.		
56. The action of fuming sulphuric acid on triphenylsilicol. By Geoffrey Martin and Frederic Stanley Kipping	66	489
57. The ignition-temperatures of gases. By Harold Baily Dixon and Hubert Frank Coward	67	514
58. The alkaloids of Senecio latifolius. By Henry Edgar Watt	68	466
59. An interpretation of the Hantzsch-Werner hypothesis. By Martin Onslow Forster and Frederick Percy Dunn	68	425
60. The triazo-group. Part IX. Transformation of cinnamoylazoimide into cinnamenylcarbimide (cinnamenyl *iso*cyanate). By Martin Onslow Forster	69	433
61. Experiments on the Walden inversion. Part II. The interconversion of the optically active mandelic acids. By Alex. McKenzie and George William Clough	70	777
62. Diazohydroxylamino-compounds and the influence of substituting groups on the stability of their molecules. By Norman Leslie Gebhard and Herbert Bryan Thompson	70	767
63. Tetraketopiperazine. Part II. By Alfred Theophilus de Mouilpied and Alexander Rule	71	549
64. The miscibility of the pyridine bases with water and the influence of a critical-solution point on the shape of the melting-point curve. By Otto Flaschner	71	668
65. The preparation of dichlorocarbamide. By Frederick Daniel Chattaway	72	464
66. Thiotetrahydroquinazolines, methylenecarbamides, dicarbanilinomethylenediamines, and their homologues. By Alfred Senier and Frederick George Shepheard	72	494
67. The distillation of butter-fat, cocoanut oil, and their fatty acids. By Kenneth Somerville Caldwell and William Holdsworth Hurtley	73	853
68. Note on the detection of white or ordinary phosphorus in the igniting composition of lucifer matches. By Thomas Edward Thorpe	73	440
69. Intramolecular rearrangement of the diphenylamine sulphoxides. (Preliminary note.) By Edward de Barry Barnett and Samuel Smiles	74	—

	Page in Proceedings.	Page in Transactions.
70. A crystalline bleaching powder. By Kennedy Joseph Previté Orton and William Jacob Jones	74	751
71. The action of carbon dioxide on nitrites. By Ernest Robert Marle	74	—
72. Estimation of primary, secondary, and tertiary amines. Part I. By John Joseph Sudborough and Harold Hibbert	75	477
73. The condensation of ketones and aldehydes with the sodium derivative of ethyl cyanoacetate. By Walter Norman Haworth	76	480
74. Experiments on the constitution of the aloins. Part I. (Preliminary note.) By Robert Robinson and John Lionel Simonsen	76	—
75. The constituents of Canadian hemp. Part II. Cynotoxin. (Preliminary note.) By Horace Finnemore	77	—

March 18*th.*

	Page in Proceedings.	Page in Transactions.
76. Liquid and solid radium emanation. By Robert Whytlaw Gray and Sir William Ramsay, K.C.B.	82	—
77. Optically active substances which contain no asymmetric atom.” (Preliminary note.) By William Henry Perkin, William Jackson Pope, and Otto Wallach	83	—
78. The constituents of the rhizome of Apocynum androsæmifolium. By Charles Watson Moore	85	734
79. The action of phosphorus pentachloride on the methylene ethers of catechol derivatives. Part IV. Derivatives of dihydroxyphenyl-acetic, -glycollic, and -glyoxylic acids. By George Barger and Arthur James Ewins	86	552
80. Studies in the azine series. Part I. The constitution of safranine. By John Theodore Hewitt, Sidney Herbert Newman, and Thomas Field Winmill	86	577
81. The condensation of amides with esters of acetylenic acids. By Siegfried Ruhemann	87	984
82. Studies in asymmetric synthesis. Part VII. The influence of the *d*-amyl group. By Alex. McKenzie and Hermann August Müller	88	544
83. Contributions to the chemistry of cholesterol and coprosterol. By Charles Dorée	88	638
84. Iodine dioxide. By Matthew Moncrieff Pattison Muir	88	656
85. A polarimetric method of identifying chitin. By James Colquhoun Irvine	89	564
86. The conversion *d*-α-methyl*iso*serine into *d*-α-methylglyceric acid. By Francis William Kay	90	560
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14. For the purpose of revision and cleaning, the Library shall be closed for a fortnight in August of each year; before which time all books must be returned, unless special permission has been previously obtained from the Librarian. In the event of any book not being returned on such occasion, the Council may replace it at the cost of the borrower.

15. No persons other than Fellows of the Society have the privilege of using the Library, except upon a written introduction from a Fellow, with whom rests the responsibility for all books consulted by the person introduced. Such introduction shall be valid for one occasion only.

ADDITIONS TO THE LIBRARY DURING THE YEAR 1909.

Abderhalden, *Emil.* [Editor.] Handbuch der biochemischen Arbeitsmethoden. Vols. I. i., II. i. pp. iv + 512, 496. ill. Wien 1909.

Abegg, *Richard.* See **Handbuch der anorganischen Chemie.**

Abegg, *Richard,* and **Sackur,** *O.* Physikalisch-Chemische Rechenaufgaben. pp. 104. Leipzig 1909.

Académie des Sciences, Paris. Comptes rendus hebdomadaires des séances de l'Academie. Vol. lxxiv—lxxxv. 12 vols. Paris 1872–77.

Accum, *Fredrick.* A practical treatise on the use and application of chemical tests. 3rd edition. pp. 527. ill. London 1820.

Alexander, *Jerome.* See **Zsigmondy,** *Richard.*

Allen, *Alfred Henry.* Commercial organic analysis. A treatise on the properties, modes of assaying, and proximate analytical examination of the various organic chemicals and products employed in the arts, manufactures, medicine, etc. With concise methods for the detection and estimation of their impurities, adulterations, and products of decomposition. 4th edition. Edited by *Henry* **Leffmann** and *W. A.* **Davis.** Vol. I. pp. x + 576. ill. London 1909.

Anschütz, *Richard.* See **Richter,** *Victor von.*

Appleton, *H. A.* See **Simmonds,** *William Herbert.*

Archibald, *R. D.*, and **Rankin,** *R.* Electrical laboratory course. pp. vi + 95. ill. London 1908.

Archibald, *Robert George.* See **Gordon Memorial College, Khartoum.**

Aschan, *Ossian.* Ueber die Konstitution des Isopinens. (From the *Öfversigt Finska Vetensk. Soc. Förhandl.*, 1908–1909, **51**, *A.*)

Auerbach, *Friedrich,* and **Plüddemann,** *Werner.* Massanalytische Bestimmung von Ameisensäure und ihren Salzen. (From the *Arbeiten K. Gesundheitsamte,* 1909, **30.**)

Auerbach, *Fr.* See **Handbuch der anorganischen Chemie.**

Balfour, *Andrew.* See **Gordon Memorial College, Khartoum.**

Barger, *George,* and **Dale,** *Henry Hallett.* The water-soluble active principles of ergot. (From the *J. Physiol.*, 1909, **38.**)

Barger, *George,* and **Walpole,** *George Stanley.* Isolation of the pressor principles of putrid meat. (From the *J. Physiol.*, 1909, **38.**)

Baron, *Harold.* Chemical industry on the Continent. A report to the Electors of the Gartside Scholarships. pp. xi + 71. Manchester 1909.

Barschall, *Hermann.* Über Krabbenextrakt. (From the *Arbeiten K. Gesundheitsamte*, 1909, **30.**)

Baur, *Emil.* Über die Bestimmung des Zuckers im Fleisch. (From the *Arbeiten K. Gesundheitsamte*, 1909, **30.**)

Bedford, Duke of. See **Woburn Experimental Fruit Farm.**

Bein, *W.* Zur Ausdehnung des Aethylaethers und einiger Mischungen des aethers mit Aethylalkohol. (From the *Abhandl. K. Normal-Eichungskom*, 1908, **7.**)

Bergtheil, *Cyril.* See **Bihar Planters' Association.**

Bertiaux, *L.* See **Hollard,** *A.*

Bihar Planters' Association. Report of the Indigo Research Station. Sirsiah, for the year 1908–1909. By *Cyril* **Bergtheil.** pp. 24. Calcutta 1909.

Biltz, *Heinrich,* and **Biltz,** *Wilhelm.* Laboratory methods of inorganic chemistry. Authorised translation by *William T.* **Hall** and *Arthur A.* **Blanchard.** pp. xv + 258. ill. New York 1909.

Biltz, *Wilhelm.* See **Biltz,** *Heinrich.*

Birckenbach, *L.* Die Untersuchungsmethoden des Wasserstoffperoxyds. (Die chemische Analyse, Vol. VII.) Stuttgart 1909.

Blair, *David.* A grammar of the principles and practice of chemistry. pp. vi + 255. ill. London 1815.

Blanchard, *Arthur A.* See **Biltz,** *Wilhelm.*

Blount, *Bertram.* The composition of commercial petrols. [Paper read before the Incorporated Institution of Automobile Engineers on March 10th, 1909.] pp. 6. London 1909.

Bobertag, *O.* See **Fischer,** *H. Waldemar.*

Bongiovanni, *Corrado.* Sulla ricerca microchimica del fosforo nei vegetali. (From the *Atti R. Istituto Veneto*, 1907–08, **67.**)

—— Nuovi modi di colorazione delle formazioni fosforate vegetali. (From *Le Staz. sper. agrar. ital.*, 1909, **42.**)

Bontoux, *Émile.* See **Lewkowitsch,** *Julius.*

Bowman, *Frederic Hungerford.* The structure of the cotton fibre in its relation to technical applications. pp. xx + 470. ill. London 1908.

—— The structure of the wool fibre and its relation to the use of wool for technical purposes. pp. xx + 475. London 1908.

Boyle, *Robert.* Opera varia, quorum posthac exstat catalogus. Cum indicibus necessariis, multisque figuris æneis. Genevæ 1680. 12 parts. (2 copies, 1 wanting portrait.)

—— Experimentorum novorum physico-mechanicorum continuatio secunda, *etc.* pp. viii + 132. ill. Genevæ 1682. (2 copies.)

—— Apparatus ad historiam naturalem sanguinis humani, ac spiritus præcipue ejusdem liquoris. pp. viii + 47. Genevæ 1686.

—— Observationes de Salsedine Maris. pp. 23. Genevæ 1686.

—— Tentamen porologicum sive ad porositatem corporum tum animalium, tum solidorum detegendam. pp. vi + 46. Genevæ 1686.

—— De specificorum remediorum cum corpusculari philosophia concordia, *etc.* pp. viii + 64. Genevæ 1687.

—— Tractatus de ipsa natura, *etc.* pp. xvi + 111. Genevæ 1688.

—— Origo formarum et qualitatum juxta philosophiam corpuscularem, *etc.* pp. xxxii + 147. Genevæ 1688.

—— Noctiluca aeria sive nova qúædam phænomena in substantiæ factitiæ sive artificialis, Sponte Lucidæ, productione observata, *etc.* pp. 108. Genevæ 1693.

—— Summa veneratio Deo ab humano intellectu debita, *etc.* pp. 43. Genevæ 1693.

—— Medicina hydrostatica, sive hydrostatica materiæ medicæ applicata, *etc.* pp. xii + 70. Coloniæ Allobrogum 1693.

—— De amore seraphico seu de quibusdam ad Dei amorem stimulis. pp. viii + 59. Genevæ 1693.

—— Experimenta nec non observationes circa variarum particularium qualitatum originem, sive productionem mechanicam: Quibus accesserunt tractatus quo imperfecta chymistarum doctrina de qualitatibus detegitur, & quædam in hypothesin de alcali & acido animadversiones. pp. xvi + 144. Genevæ 1694.

—— Exercitationes circa utilitatem philosophiæ naturalis experimentalis, *etc.* pp. xvi + 602. Genevæ 1694.

—— Novorum experimentorum physico-mechanicorum continuatio prima, *etc.* pp. xii + 123. ill. Genevæ 1694.

—— Experimenta et notæ circa producibilitatem chymicorum principiorum: Quæ sunt totidem partes appendicis ad Scepticum Chymicum. pp. xii + 92. Genevæ 1694.

—— Examen dialogi physici domini T. Hobbs, de natura aëris, *etc.* pp. viii + 67. Genevæ 1695.

—— Tractatus varii continentes nova experimenta circa relationem inter flammam & aerem et circa explosiones, *etc.* pp. iv + 120. Genevæ 1696.

—— Generalia capita pro historia naturali regionum majorum vel minorum, *etc.* pp. iv + 39. Genevæ 1696.

Boyle, *Robert.* Excellentia theologiæ cum naturali philosophia, *etc.* pp. viii + 87. Genevæ 1696.

Bradley, *W. P.*, **Browne,** *A. W.*, and **Hale,** *C. F.* Effect of mechanical vibration upon carbon dioxide near the critical temperature. II. (From the *Physical Review,* 1908, **26.**)

—— Liquid above the critical temperature. (From the *Physical Review,* 1908, **27.**)

Breinl, A., and **Nierenstein,** *M.* Zum Mechanismus der Atoxylwirkung. (From the *Zeitsch. Immunitätsforsch. exp. Therap.*, 1909.)

Brode, *Johannes,* and **Lange,** *Wilhelm.* Beitrage zur Chemie des Essigs mit besonderer Berücksichtigung seiner Untersuchungsverfahren. (From the *Arbeiten K. Gesundheitsamte,* 1909, **30.**)

Browne, *A. W.* See **Bradley,** *W. P.*

Browning, *Philip E.* Introduction to the rarer elements. 2nd edition. pp. x + 207. New York 1908.

Bruni, *Giuseppe.* Feste Lösungen und Isomorphismus. pp. vi + 130. Leipzig 1908.

Bucherer, *Hans Th.* See **Möhlau,** *Richard.*

Calmette, *A.* Recherches sur l'épuration biologique et chimique des eaux d'égout. Vols. 3 & 4. pp. v + 274, iv + 214. ill. Paris 1908–09.

Cavalier, *J.* Leçons sur les alliages métalliques. pp. xix + 466. ill. Paris 1909.

Caven, *Robert Martin.* Systematic qualitative analysis. pp. xii + 240. London 1909.

Church, *Arthur Herbert.* See **Royal Society of London.**

Clowes, *Frank,* and **Coleman,** *J. Bernard.* Quantitative chemical analysis. 8th edition. pp. xxiv + 565. ill. London 1909.

—— —— Elementary practical chemistry. Part II. Analytical chemistry. 6th edition. pp. xv + 241. ill. London 1909.

Coleman, *J. Bernard.* See **Clowes,** *Frank.*

Collins, *S. H.* On the difference between duplicates as a measure of error. (From the *Proc. Univ. Durham Phil. Soc.*, 1908–9, **3.**)

Cook, *John.* Clavis Naturæ: or, the mystery of philosophy unvail'd. pp. xiv + 405. London 1733.

Crookes, *Sir William.* Diamonds. pp. xvi + 146. ill. London 1909.

—— See **Ville,** *Georges.*

Curtius, *Theodor.* Die Enthüllung des Bunsen-Denkmales. pp. 40. ill. Heidelberg, 1908.

Dale, *Henry Hallett.* Note on nutmeg-poisoning. (From the *Proc. Roy. Soc. Med.*, 1909.)

—— See **Barger,** *George.*

Dale, *Henry Hallett*, and **Dixon**, *Walter Ernest*. The action of pressor amines produced by putrefaction. (From the *J. Physiol.*, 1909, **39**.)

Dannerth, *Frederic*. The methods of textile chemistry. pp. viii + 164. New York 1908.

Davis, *W. A.* See **Allen**, *Alfred Henry*.

Delbrück, *Max*. [*Editor.*] Brauerei-Lexikon. Parts 1—8. pp. 1—544. ill. Berlin 1909. (*Reference.*)

Dezani, *Serafino*. Le basi proteiche contenute nello sperma e nelle ovaie del tonno ed i loro prodotti idrolitici. (From the *Giorn. R. Accad. Med. Torino*, 1908, **14**.)

—— Lecitine e colesterine contenute nello sperma e nelle ovaie del tonno. (From the *Giorn. R. Accad. Med. Torino*, 1909, **15**.)

Diergart, *Paul*. [*Editor.*] Beiträge aus der Geschichte der Chemie dem Gedächtnis von Georg W. A. Kahlbaum. pp. xv + 652. ill. Leipzig 1909.

Ditmar, *Rudolf*. Die Analyse des Kautschuks, der Guttapercha, Balata und ihrer Zusätze, mit einschluss der Chemie der genannten Stoffe. pp. viii + 288. ill. Wien 1909.

Dixon, *Walter Ernest*. See **Dale**, *Henry Hallett*.

Donnan, *Frederick George*. Kupfer und seine Verbindungen. [Abegg's Handbuch der Anorganischen Chemie. II. i.] pp. 469 to 654.

Douris, *Roger*. Sur la tiodine. (From the *Bull. Sci. pharm.*, 1908.)

Dunstan, *Albert Ernest*. An organic chemistry for schools and technical institutes. pp. viii + 160. ill. London 1908.

Duvivier, *Carl*. Recherches sur la préparation électrolytique des composés du plomb. pp. 19. Malines 1909.

Eibner, *A*. Malmaterialienkunde als Grundlage der Maltechnik. pp. xxiii + 480. Berlin 1909.

Eijkman, *J. F.* Tafeln zum gebrauche bei der Bestimmung von Brechungsindices nach der Methode der konstanten Deviation von 40°. pp. [102]. Groningen 1909.

Evans, Sons, Lescher, and Webb, Ltd. Analytical notes. 1908. pp. 48. Liverpool 1909.

Falk, *K. George*. See **Nelson**, *J. M.*

Fermor, *L. Leigh*. Note on a group of Manganates, comprising Hollandite, Psilomelane, and Coronadite. (From the *Records, Geol. Survey of India*, 1908, **36**.)

Fischel, *Alfred*. Über Beeinflussung der vitalen Nervenfärbung durch chemische Agentien. (From the *Zentr. Physiol.*, 1908, **22**.)

Fischer, *Emil.* Untersuchungen über Kohlenhydrate und Fermente (1884—1908). pp. viii + 912. Berlin 1909.

Fischer, *H. Waldemar.* Untersuchungen über Metallhydroxyde. pp. 80. Breslau 1907.

Fischer, *H. Waldemar*, and **Bobertag**, *O.* Zur Theorie der reversibelen Sole. (From the *Jahrsb. Schles. Ges. vaterländ. Cult. Naturwiss. Sek.*, 1908.)

Fleischer, *S. M.* See **Loeb**, *Leo.*

Forrest, *C. N.* See **Richardson**, *Clifford.*

Friend, *J. Newton.* The theory of valency. pp. xiv + 180. London 1909.

Fulda, *W.* Die Absorption des Schwefeldioxyds in Wasser. (From the *Arbeiten K. Gesundheitsamte*, 1909, **30**.)

Gadd, *H. Wippell.* The poisons and pharmacy act, 1908. With notes. pp. 55. London 1909.

Gallo, *Nicolò.* Dei correttivi dell' acidità e di un nuovo metodo per la determinazione dell' acidità volatile libera nei vini. (From *Le Staz. sper. agrar. ital.*, 1909, **42**.)

Gemmell, *George Harrison.* Chemical notes and equations, inorganic and organic. 2nd edition. pp. xiii + 265. London 1909.

Geological Society of London. The Centenary. Celebrated September 26th to October 3rd, 1907. Recorded by *W. W.* **Watts**. pp. iv + 166. ill. London 1909.

Ghose, *Anu.* The mode of occurrence of manganite in the manganese ore deposits of the Sandur State, Bellary, Madras, India. (From the *Trans. Inst. Min. Eng.*, 1908.)

Goerner, *Paul.* Aromatische Nitroderivate insbesondere Nitrophenole als Alkaloidfaellungsmittel. pp. 45. Strassburg 1908.

Golding, *John.* Adaptation. (From the *Report and Trans. Nottingham Nat. Soc.*, **56**, 1907–1908.)

Gordon Memorial College, Khartoum. Third report of the Wellcome Research Laboratories. pp. 477. ill. London 1908.

—— Supplement to the third report. Review of some of the recent advances in tropical medicine. By *Andrew* **Balfour** and *R. G.* **Archibald**. pp. 251. London 1908.

Grünwald, *Hermann Friedrich.* Ueber die Lebenswichtigkeit der Chloride für den Organismus. (From the *Zentr. Physiol.*, 1908, **22**.)

Guttmann, *Oscar.* The manufacture of explosives. Twenty years' progress. Four Cantor Lectures delivered at the Royal Society of Arts in November and December, 1908. pp. viii + 84. ill. London 1909. (2 copies.)

Haanel, *Eugene.* Report on the investigation of an electric shaft furnace, Domnarfvet, Sweden, &c. (Canadian Department of Mines. pp. 38. ill. Ottawa, 1909.

Haensel, *Heinrich.* Bericht, April–September, 1908, Oktober–März, 1908–09. pp. 83, 82.

Hale, *C. F.* See **Bradley**, *W. P.*

Hall, *Alfred Daniel.* The soil. 2nd edition. pp. xv + 311. ill. London 1908.

Hall, *William T.* See **Biltz**, *Wilhelm.*

Haller, *Albin.* Les récents progrès de la chimie. (Troisième série.) Conférences faites au Laboratoire de Chimie organique de la Sorbonne, sous la direction de A. Haller. pp. 261. Paris 1908.

Handbuch der anorganischen Chemie. Edited by *Richard* **Abegg** and *Fr.* **Auerbach.** Vol. III. Part II. pp. xii + 921. Leipzig 1909. (*Reference.*)

Harden, *Arthur.* See **Roscoe**, *Sir Henry Enfield.*

Henrich, *Ferdinand.* Neuere theoretische Anschauungen auf dem Gebiete der organischen Chemie. pp. xiv + 294. Braunschweig 1908.

Hinrichsen, *F. W.* Die Untersuchung von Eisengallustinten. (Die chemische Analyse, Vol. VI.) pp. 140. Stuttgart 1909.

Hollard, *A.*, and **Bertiaux**, *L.* Analyse des métaux par électrolyse 2nd edition. pp. 256. Paris 1909.

Horn, *Georg.* Arca Mosis, sive Historia Mundi. pp. [xxxiv] + 200 + [xx]. Lugd. Bat. & Roterod. 1668.

Houston, *A. C.* See **Metropolitan Water Board.**

Hoyt, *D. M.* See **Loeb**, *Leo.*

Hubert, *Paul.* Plantes à parfums. pp. xii + 610. ill. Paris 1909.

India. *Imperial Department of Agriculture.* Report for the years 1905–06 and 1906–07. Calcutta 1908.

Indian Association for the Cultivation of Science. Report for the year 1907. pp. 65. Calcutta 1909.

International Congress of Applied Chemistry, VII. *Explosives Section.* The rise and progress of the British explosives industry. pp. xiv + 418. ill. London 1909.

Iron and Steel Institute. Carnegie Scholarship Memoirs. Vol. I. pp. xii + 368. ill. London 1909.

Jackson, *A. Hendrick.* The lead accumulator electrolyte. [1908.]

Jago, *William.* A manual of forensic chemistry dealing especially with chemical evidence, its preparation and adduction. Based upon a course of lectures delivered at University College, University of London. pp. viii + 256. London 1909.

James, *T. Campbell.* See **Sudborough**, *John Joseph.*

Jörgensen, *S. M.* Die Entdeckung des Sauerstoffes. Aus dem

Dänischen von *Vilhelm* **Ortwed** und *Max* **Speter.** (Sammlung, Vol. XIV.) Stuttgart 1909.

Johnson, *Charles Morris.* Rapid methods for the chemical analysis of special steels, steel-making alloys, and graphite. pp. vi + 221. New York 1909.

Johnson, *Grove.* The student's manual of yeast culture. pp. xv + 180. ill. London 1908.

Kahlbaum, *Georg W. A.* See **Diergart,** *Paul.*

Keane, *Charles Alexander.* Modern organic chemistry. pp. xv + 503. ill. London 1909.

Kiliani, *Heinrich.* See **Miller,** *Wilhelm von.*

Kissling, *Richard.* Das Erdöl, seine Verarbeitung und Verwendung. Eine gedrängte Schilderung des Gesamtgebietes der Erdöl-Industrie. pp. x + 154. ill. Halle a. S. 1908.

Knapman, *John William.* See **Pharmaceutical Society of Great Britain.**

König, *Franz Josef.* Chemie der menschlichen Nahrungs- und Genussmittel. 4th edition. Vol. III. Untersuchung von Nahrungs-, Genussmitteln und Gebrauchsgegenständen. Teil I. Allgemeine Untersuchungsverfahren. pp. xiv + 772. ill. Berlin [1909].

Kremann, *R.* Ueber die Anwendung der thermischen Analyse zum Nachweis chemischer Verbindungen. (Sammlung, Vol. XIV.) Stuttgart 1909.

Ladenburg, *A.* See **Wurtz,** *Adolf.*

Ladenburg, *M.* See **Wurtz,** *Adolf.*

Lange, *Wilhelm.* See **Brode,** *Johannes.*

Laqueur, *E.* Über die Wirkung von Gasen auf die Autolyse mit Rücksicht auf ihre Beeinflussung des Stoffwechsels. (From the *Schriften. Physik.-ökonom. Ges. Königsberg i. Pr.*, 1909, **50.**)

—— Über die Wirkung des Arsens auf die Autolyse. (From the *Schriften. Physik.-ökonom. Ges. Königsberg i. Pr.*, 1907, **48.**)

Laubenheimer, *Kurt.* Phenol und seine Derivate als Desinfektionsmittel. pp. vi + 156. Berlin 1909.

Law, *Edward F.* Alloys and their industrial applications. pp. xvi + 269. ill. London 1909.

Leffmann, *Henry.* See **Allen,** *Alfred Henry.*

Lehmann, *Ludwig.* See **Witt,** *Otto N.*

Lett, *Stephen J.* More about Zambesia minerals. (From the *Mining Journal*, 1908.)

Lewkowitsch, *Julius.* Chemical technology and analysis of oils, fats, and waxes. 4th edition. 3 vols. pp. xx + 542, xii + 816, viii + 407. ill. London 1909.

—— Technologie et analyse chimiques des huiles, graisses et cires.

Traduit . . . par *Émile* **Bontoux**. Tome II. pp. xiii + 563 to 1423. ill. Paris 1909.

Liebig, *Justus von*. See **Volhard**, *Jacob*.

Linnean Society of London. The Darwin-Wallace Celebration held on Thursday, 1st July, 1908. pp. viii + 134. ill. London 1908.

Lister Institute of Preventive Medicine. Collected papers, No. 5. London 1908. (*Reference.*)

Loeb, *Jacques*. Die chemische Entwicklungserregung des tierischen Eies. (Künstliche Parthenogenese.) pp. xxiv + 259. ill. Berlin 1909.

Loeb, *Leo*, **Fleisher**, *S. M.*, and **Hoyt**, *D. M.* Über den Einfluss von Calciumchlorid auf die Bildung von Transsudaten. (From the *Zentr. Physiol.*, 1908, **22**.)

Lundén, *Harald*. Affinitätsmessungen an schwachen Säuren und Basen. (Sammlung, Vol. XIV.) Stuttgart 1908.

Lunge, *George*. Technical chemists' handbook. Tables and methods of analysis for manufacturers of inorganic chemical products. pp. xv + 260. ill. London 1908.

—— Handbuch der Soda-Industrie und ihrer Nebenzweige. 3rd edition. Vol. II. (Bolley's *Handbuch* Neue Folge, 16.) pp. xviii + 868. ill. Braunschweig 1909.

—— The manufacture of sulphuric acid and alkali, with the collateral branches. 3rd edition. Vol. II. Sulphate of soda, hydrochloric acid, Leblanc soda. 2 vols. pp. xx + 490, xii + 493 to 1010. ill. London 1909.

Mameli, *E.*, and **Patta**, *A.* Sull' acido para-iodiofenilarsinico e sull' ioduro di para-iodiofenilarsenico. (From the *Boll. Soc. Med.-Chirurg. Pavia*, 1909.)

Marchlewski, *L.* Die Chemie der Chlorophylle und ihre Beziehung zur Chemie des Blutfarbstoffs. pp. x + 187. ill. Braunschweig 1909.

Martindale, *W. Harrison*. Organic arsenic compounds. A communication to the International Congress of Applied Chemistry, 1909. Pharmaceutical chemistry section. pp. 11. London 1909.

Martindale, *W. Harrison*, and **Westcott**, *W. Wynn*. The extra pharmacopœia. 13th edition. pp. xl + 1164. London 1908.

Mathewson, *C. H.* First principles of chemical theory. pp. vii + 123. New York 1908.

Matthews, *J. Merritt*. Laboratory manual of dyeing and textile chemistry. pp. xii + 363. New York 1909.

Mayer, *Charles*. See **Zerr**, *George*.

Mees, *Charles Edward Kenneth*. An atlas of absorption spectra. pp. 74. ill. London 1909.

Mees, *Charles Edward Kenneth.* The photography of coloured objects. pp. vi + 69. ill. Croydon 1909.

Meininger, *Ernst.* Beitrag zur Kenntnis einiger Gummiarten. Mülhausen, 1908.

Metropolitan Water Board. Fourth report on research work. By *A. C.* **Houston.** pp. 18. London 1909.

—— Report on the results of the chemical and bacteriological examination of the London waters for the twelve months ended 31 March, 1909. By *A. C.* **Houston.** pp. 42. London 1909.

Meyer, *Hans.* Analyse und Konstitutionsermittelung organischer Verbindungen. 2nd edition. pp. xxxii + 1003. Berlin 1909.

Meyer, *Kirstine.* Temperaturbegrebets Udvikling gennem Tiderne samt dets sammenhæng med vexlende Forestillinger om Varmens Natur. pp. 182. Copenhagen 1909.

Mielck, *Wilhelm.* Pharmakognostisch-chemische Untersuchung des javanischen Lackharzes "Gala-Gala." Strassburg 1908.

Miller, *Wilhelm von*, und **Kiliani**, *Heinrich.* Kurzes Lehrbuch der analytischen Chemie. 6th edition. pp. xi + 643. ill. München 1909.

Möhlau, *Richard*, and **Bucherer**, *Hans Th.* Farbenchemisches Praktikum zugleich Einführung in die Farbenchemie und Färbereitechnik. pp. x + 374. ill. Leipzig 1908.

Morgan, *J. Livingston R.* The elements of physical chemistry. 4th edition. pp. xiv + 539. New York 1908.

—— Physical chemistry for electrical engineers. 2nd edition. pp. x + 249. New York 1909.

Moser, *L.* Die Bestimmungsmethoden des Wismuts und seine Trennung von den anderen Elementen. (Die chemische Analyse, Vol. X.) Stuttgart 1909.

Musu-Boy, *Roberto.* Lo Zinco. pp. xvi + 219. ill. Milano 1909.

Naske, *Carl.* Die Portland-Zement-Fabrikation. 2nd edition. pp. vii + 410. ill. Leipzig 1909.

Nebraska, University of. *Agricultural Experiment Station.* Twenty-second annual report. pp. 158. ill. Lincoln, Nebraska, 1909.

Nelson, *J. M.*, and **Falk**, *K. George.* The electron conception of valency in organic chemistry. (From the *School of Mines Quarterly*, 1909, **30**.)

Neubauer, *Otto.* Ueber den Abbau der Aminosäuren in gesunden und kranken Organismus. (From the *Deut. Archiv. klin. Med.*, 1909, **95**.)

Newlands, *Benjamin E. R.* See **Newlands**, *John A. R.*

Newlands, *John A. R.*, and **Newlands**, *Benjamin E. R.* Sugar. A handbook for planters and refiners. pp. xxxvi + 876. ill. London 1909.

New Zealand, *Department of Agriculture. Chemistry division.* Report, 1908. pp. 322. ill. Wellington 1908.

Nierenstein, *M.* See **Breinl,** *A.*

Noll, *A.* Über Fettsynthese im Darmepithel des Frosches bei der Fettresorption. (From the *Archiv. Anat. Physiol., Physiol. Abtlg. Suppl.*, 1908.)

Olsen, *John C.* See **Van Nostrand.**

Oppenheimer, *Carl.* Die Fermente und ihre Wirkungen. Spezieller Teil. 3rd edition. pp. xi + 491. Leipzig 1909.

Ortwed, *Vilhelm.* See **Jörgensen,** *S. M.*

Osborne, *Thomas B.* The vegetable proteins. pp. xiii + 125. London 1909.

Ostwald's Klassiker. See **Wurtz,** *Adolf.*

Ostwald, *Wolfgang.* Grundriss der Kolloidchemie. pp. xiv + 525. Dresden 1909.

Owen, *F. A.* The dyeing and cleaning of textile fabrics. Based partly on notes of *H. C.* **Standage.** pp. vi + 253. New York 1909.

Palladino, *Pietro.* Du poids absolu des corps élémentaires et dépendance de leurs propriétés chimiques et physiques du poids absolu et de la forme. pp. 44. ill. Genova 1909.

Parry, *Ernest J.* The chemistry of essential oils and artificial perfumes. 2nd edition. pp. viii + 546. ill. London 1908.

Parry, *L.* Systematic treatment of metalliferous waste. pp. 121. London [1909].

Patta, *A.* See **Mameli,** *E.*

Percival, *John.* See **Ville,** *Georges.*

Perotti, *Renato.* Su la nutrizione azotata della pianta a mezzo dello sostanze amidate. (From *Le Staz. sper. agrar. ital.*, 1908, **41.**)

Pfyl, *B.*, and **Rasenack,** *P.* Ueber die Verpuffungs und Verbrennungsprodukte von Zelluloid. (From the *Arbeiten K. Gesundheitsamte*, 1909, **32.**)

Pharmaceutical Society of Great Britain. Catalogue of the Library. 9th edition. Compiled by *John William* **Knapman.** pp. 715. London 1905. (*Reference.*)

Pickering, *Spencer U.* See **Woburn Experimental Fruit Farm**

Plimmer, *R. H. Aders.* The chemical constitution of the proteins. In 2 parts. pp. xii + 100, xi + 66. London 1908.

Plüddemann, *Werner.* See **Auerbach,** *Friedrich.*

Quartaroli, *A.* Contributo allo studio dei fosfati, delle loro isomerie e delle trasformazioni che essi subiscono nel terreno. (From the *Staz. sper. agrar. ital.*, 1909, **42.**)

Rankine, *R.* See **Archibald,** *R. D.*

Rasenack, *P.* See **Pfyl,** *B.*

Rathje, *Arnold.* Neuere Untersuchungen der Fette von Lycopodium, Secale cornutum, Semen Arecae und Semen Aleuritis cordatae sowie der brasilianischen Pflanzenmilch Amapa. Kiel 1908.

Richards, *Ellen H.* Laboratory notes on industrial water analysis. pp. iii + 49. New York 1908.

Richards, *Theodore William,* [and others]. Experimentelle Untersuchungen über Atomgewichte. pp. viii + 890. ill. Hamburg 1909.

Richardson, *Clifford.* Bituminous materials for use in and on road surfaces, and means of determining their character. pp. 11. New York 1909.

—— Asphalt macadam roadways. pp. 6. ill. New York 1909.

Richardson, *Clifford,* and **Forrest,** *C. N.* Methods for the examination of bituminous materials for road construction as practised in the New York Testing Laboratory. pp. 8. New York 1909.

Richter, *Victor von.* Chemie der Kohlenstoffverbindungen oder organische Chemie. Edited by *R.* **Anschütz** and *G.* **Schroeter.** Vol. I. Die Chemie der Fettkörper. 11th edition. pp. xx + 793. Bonn 1909. (*Reference.*)

Rohland, *P.* Über das Verhalten von suspendierten Stoffen im Kristalloid und Kolloidzustand. (From the *Physik.-chem. Centr.*, 1908, **6**.)

Roscoe, *Sir Henry Enfield,* and **Schorlemmer,** *Carl.* A treatise on chemistry. Vol. II. The metals. New edition, completely revised by *Sir H. E.* **Roscoe** and *A.* **Harden.** pp. xvi + 1436. ill. London 1907.

Royal Society of London. Some account of the "letters and papers" of the period 1741–1806 in the archives. With an index of authors. Compiled by *A. H.* **Church.** pp. 73. Oxford. Printed for the author. 1908.

Rübencamp, *R.* See **Zerr,** *George.*

Rupe, *Hans.* Die Chemie der natürlichen Farbstoffe. Teil II. (Bolley's *Handbuch,* 61.) pp. ix + 236. Braunschweig 1909.

Rusconi, *Arnaldo.* Ricerca dell' alcool etilico nel cloroformio. (From the *Arch. Farmacol. sper. Sci. affini,* 1909, **8**.)

Sackur, *O.* See **Abegg,** *Richard.*

Savoia, *Umberto.* Metallografia. pp. xvi + 208. ill. Milano 1909.

Schall, *C.* Zur Demonstration der Absorption farbloser Lösungen im Ultraviolett. (From the *Zeitsch. physikal. chem. Unter.*, 1908.)

—— Über Zersetzung von Tetrachlorkohlenstoffdampf im elektrischen Hochspannungs-Lichtbogen. (From the *Zeitsch. physikal. chem. Unter.*, 1908.)

Schenck, *Rudolf.* Physikalische Chemie der Metalle. Sechs Vorträge über die wissenschaftlichen Grundlagen der Metallurgie. pp. vi + 193. ill. Halle a. S. 1909.

Schimmel & Co. Semi-annual report, November, 1908.

—— Bericht, April, 1909. pp. 233, 133.

Schimpf, *Henry W.* A manual of volumetric analysis for the use of pharmacists, sanitary and food chemists. 5th edition. pp. xx + 725. ill. New York 1909.

Schorlemmer, *Carl.* See **Roscoe,** *Sir Henry Enfield.*

Schroeter, *G.* See **Richter,** *Victor von.*

Schryver, *Samuel Barnett.* The general characters of the proteins. pp. x + 86. London 1909.

Schucht, *Ludwig.* Die Fabrikation des Superphosphats, mit Berücksichtigung der anderen gebräuchlichen Düngemittel. 3rd edition. pp. viii + 460. ill. Braunschweig 1909.

Senter, *George.* Outlines of physical chemistry. pp. xvii + 369. ill. London 1909.

Siebeck, *Adolf.* Ueber einige organische Eisensalze. Wattenscheid 1908.

Simmer, *August.* Ueber das Verhalten der Alkaloidsalze und anderer organischer Substanzen zu den Lösungsmitteln der Perforationsmethode, insbesondere Chloroform, sowie über Reduktionswirkungen der Alkaloide. Strassburg 1906.

Simmons, *William Herbert,* and **Appleton,** *H. A.* The handbook of soap manufacture. pp. vii + 159. ill. London 1908.

Société chimique de France. Cinquantenaire. pp. iv + 146. (42 plates.) Paris 1908. (*Reference.*)

Sommerfeldt, *Ernst.* Thermochemische und thermodynamische Methoden, angewandt auf den Vorgang der Bildung von Mischkrystallen. Stuttgart 1900.

—— Petrographisch-chemische Untersuchungen an den Basalten des südlichen Bakony. Budapest 1908.

Speter, *Max.* See **Jörgensen,** *S. M.*

Spiegel, *Leopold.* Chemische Konstitution und physiologische Wirkung. (Sammlung, Vol. XIV.) Stuttgart 1909.

Squire, *Peter Wyatt.* Companion to the latest edition of the British Pharmacopœia, comparing the strength of its various preparations with those of the United States, and other foreign pharmacopœias, to which are added not official preparations, and practical hints on prescribing. 18th edition. pp. xlii + 1417. London 1908.

Standage, *H. C.* See **Owen,** *F. A.*

Starling, *Ernest H.* The Mercers' Company Lectures on the fluids of the body. pp. viii + 186. London 1909.

Stewart, *Alfred Walter.* Recent advances in organic chemistry. pp. xv + 296. London 1908.

Stone, *C. H.* Practical testing of gas and gas meters. pp. x + 337, ill. New York 1909.

Strauss, *Eduard.* Notiz zum Nachweis des Urobilins im Harn. (From the *Münch. med. Woch.*, 1908.)

Sudborough, *John Joseph,* and **James,** *T. Campbell.* Practical organic chemistry. pp. xvi + 378. ill. London 1909.

Symons, *Brenton.* Genesis of metallic ores and of the rocks which enclose them. pp. xxxiii + 494. ill. London 1908.

Teichert, *Kurt.* Methoden zur Untersuchung von Milch und Molkereiprodukten. (Die chemische Analyse, Vol. VIII & IX.) Stuttgart 1909.

Thorpe, *Sir Edward.* History of chemistry. Vol. I. From the earliest times to the middle of the nineteenth century. pp. viii + 148. ill. London 1909.

Transvaal. *Government Laboratories.* Annual Report for the year 1906–7, 1907–8. Pretoria 1908, 1909.

Tschelinzeff, *W.* Individuelle magnesiumorganische Verbindungen, und ihre Umwandlungen in Oxonium- und Ammonium-Komplexe. pp. iv + 271. Moscow 1908. [In Russian.]

Turner, *Thomas.* The metallurgy of iron. pp. xvi + 463. ill. London 1908.

Van Nostrand's Chemical annual, 1909. A hand-book of useful data. Edited by *John C.* **Olsen.** pp. xii + 580. London 1909.

Ville, *Georges.* Artificial manures: their chemical selection and scientific application to agriculture. New edition, revised by *Sir William* **Crookes** and *John* **Percival.** pp. xxxviii + 347. ill. London 1909.

Volhard, *Jacob.* Justus von Liebig. 2 vols. pp. xii + 45. viii + 438. ill. Leipzig 1909.

Walpole, *George Stanley.* See **Barger,** *George.*

Watt, *Sir George.* The commercial products of India. Being an abridgement of "The dictionary of economic products of India." pp. viii + 1189. London 1908.

Watts, *William Whitehead.* See **Geological Society of London.**

Wedekind, *Edgar.* Die Entwicklung der Stereochemie des fünfwertigen Stickstoffs im letzten Jahrzehnt. (Sammlung, Vol. XIV.) Stuttgart 1909.

Weiss, *Hermann.* Pharmakognostische und phytochemische Untersuchung der Rinde und der Früchte von Aegiceras majus G., mit besonderer Berucksichtigung des Saponins. Strassburg 1906.

Wentrup, *Franz.* Beiträge zur Kenntnis der Saponine. Strassburg 1908.

Werner, *Alfred.* Neuere Anschauungen auf dem Gebiete der anorganischen Chemie. pp. xv + 292. II Auflage. Braunschweig 1909.

Westcott, *W. Wynn.* See **Martindale**, *W. Harrison.*

West Indies. *Imperial Department of Agriculture.* Sugar-cane experiments in the Leeward Islands. Reports on experiments conducted . . . in the seasons 1906–7 and 1907–8. 4 parts. Barbados 1908, 1909.

Wiley, *Harvey W.* Principles and practice of agricultural analysis. Vol. II. Fertilizers and insecticides. pp. xi + 680. ill. Easton, Pa. 1908.

Witt, *Otto N.*, and **Lehmann**, *Ludwig.* Chemische Technologie der Gespinnstfasern. Lieferung 4. (Bolley's *Handbuch*, 67.) pp. 577—770. Braunschweig 1909.

Woburn Experimental Fruit Farm. Ninth and Tenth reports. By the **Duke of Bedford** and *Spencer U.* **Pickering.** pp. 95 + xlvii, pp. iv + 50. ill. London 1908, 1909.

Wright, *Herbert.* Hevea Brasiliensis, or Para rubber: Its botany, cultivation, chemistry and diseases. 3rd edition. pp. xvii + 204. ill. Colombo 1908.

Wurtz, *Adolf.* Abhandlung über die Glycole oder zweiatomige Alkohole und über das Aethylenoxyd als Bindeglied zwischen organischer und Mineralchemie. Aus dem Französischen übersetzt und mit Anmerkungen versehen von *M.* u. *A.* **Ladenburg.** (Ostwald's *Klassiker*, No. 170.) pp. 96. Leipzig 1909.

Zeitschrift für anorganische Chemie. Generalregister der Bände 1—50 (1892–1906). pp. xxiv + 652. Hamburg 1908. (*Reference.*)

Zerr, *George*, and **Rübencamp**, *R.* A treatise of colour manufacture. A guide to the preparation, examination, and application of all the pigment colours in practical use. Authorised English edition by *Charles* **Mayer.** pp. xiii + 605. ill. London 1908.

Zimmerman, *Joseph.* Ueber die Spaltung des Gypsophila-Saponins. pp. 58. Strassburg 1909.

Zsigmondy, *Richard.* Colloids and the ultramicroscope. Authorized translations by *Jerome* **Alexander.** pp. xiii + 245. ill. New York 1909.

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R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY SUFFOLK.

Issued 29/1/09

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 25. No. 350.

Thursday, January 21st, 1909, at 8.30 p.m., SIR WILLIAM RAMSAY, K.C.B., F.R.S., President, in the Chair.

The minutes of the previous meeting having been read and confirmed, Dr. DIVERS made the following inquiries. Whether one of the objects of the resolution adopted by the Council "to remove some of the disabilities experienced by women chemists" were not, as it appeared to be, to let duly qualified women be "accepted" to enjoy privileges in the Society which men, similarly qualified, were not to be permitted to enjoy on the same terms, and, that being so, whether that object were a just and lawful one? Whether the Council, in taking upon itself to "enact a regulation" (Charter, p. 6) indistinguishable in form and substance from a bye-law, had avoided exceeding its powers merely by not proceeding to call the regulation a bye-law? In what did the resolution concerning Subscribers of the Society differ from the existing bye-law for Associates, except in that an Associate must have passed a ballot of the Fellows? Was it not clear from the Charter that any action by the Council on the resolution would be invalid until the vote of a General Meeting should have made the resolution into a bye-law? Whether the Council must not be exceeding its powers in legislating for women in any way whatever, if it were indeed the case that it would be going beyond its powers were it to accept women as candidates for the Fellowship, they being, it was said, outside the consideration of the Charter? Would not even a General Meeting be exceeding its much greater powers were it to attempt to frame quasi-bye-laws for those to whom the Charter did not apply? Did the Council in its words "disabilities experienced by women" refer to its assumption that the Charter really imposed upon it disability to receive the candidature of women for the Fellowship? If so, did it need to be pointed out that disabilities, like any other ordinances, were not "experienced" by anyone, but were imposed, and that a Charter did not attempt to limit the powers of any man or woman who was not enjoying the privileges which it bestowed? In speaking of "removing disabilities" did the Council maintain that it could itself escape from or could relieve others of a disability laid upon it or upon them by the Charter? Lastly, was it to be understood that the Council believed, what its words implied, that it would be removing disabilities by granting privileges, supposing that it really could do either of these things?

Messrs. N. C. Akers, J. Brown, R. F. Easton, C. Everitt, A. F. Girvan, C. L. Norman, G. E. Pearson, W. B. Shaw, W. G. Winterson, and F. P. Worley were formally admitted Fellows of the Society.

The President announced a proposal by the Institution of Gas Engineers to perpetuate the memory of the late Sir George Livesey by establishing a Livesey Professorship in Gas Engineering and Fuel at the Leeds University; contributions to the Fund should be addressed to the Secretary of the Institution of Gas Engineers, 39, Victoria Street, Westminster.

Certificates were read for the first time in favour of Messrs.:

Alfred Bertram Coles, M.A., 42, Broadwater Road, Tottenham, N.
John Thomas Fox, Glen Burn, Stollard Street, Clay Cross, near Chesterfield.
John Thomas Furnell, 32, Grosvenor Park Road, Walthamstow.
Alfred George Cooper Gwyer, Ph.D., B.Sc., Keate House, Durdham Down, Bristol.
Robert Main Harland, 296, Willesden Lane, Willesden Green, N.W.
Henry Humphreys Jones, 18, Colquitt Street, Liverpool.
Horace Keeble, Wereham, Stoke Ferry, Norfolk.
Joseph Leedham, 176, Bromford Lane, West Bromwich.
William George Martin, B.Sc., Royal School, Armagh.
Robert Robinson, M.Sc., Field House, Chesterfield.
Herbert Rogers, Stenning House, Cobwell Road, Retford, Notts.
J. H. Charles Schulten, Ph.D., 4, Pollock Street, Calcutta.

Guy Ransom Warwick, B.A., 5 and 6, Fowkes Buildings, Great Tower Street, E.C.
Percy Charles Henry West, 40, The Green, Norton, Co. Durham.
Thomas Jabez Wild, Scott's Laboratories, Southall, Middlesex.

The Council has ordered the following letter and report to be printed in the Journal and Proceedings of the Society :

GOVERNMENT LABORATORY,
CLEMENT'S INN PASSAGE,
STRAND, LONDON, W.C.
29*th October*, 1908.

GENTLEMEN,

I beg to forward you, for presentation to the Council of the Chemical Society, the Report of the International Committee on Atomic Weights, 1909, to which I have affixed, as desired by them, the signatures of Professors Ostwald and Urbain.

The general revision of the values of the atomic weights of the elements, based on the fundamental values for hydrogen, nitrogen, the halogens, silver, etc., as ascertained by the laborious and accurate determinations which have been made in various laboratories during recent years, and to which reference was made in preceding Reports, has now been completed and the Table submitted with the present Report embodies the results of the re-calculations. A number of atomic weights are shown to be slightly influenced by the adoption of the new values, but the changes thus introduced are, it must be admitted, less profound than was generally anticipated. Certain of the values still remain affected by errors far larger than those introduced by the selection of a particular fundamental value of the element with which comparison is made.

I am, Gentlemen,
Your obedient Servant,
T. E. THORPE.

The Hon. Secretaries,
The Chemical Society,
Burlington House,
London, W.

Report of the International Committee on Atomic Weights, 1909.

Since the publication of our last Report, several important memoirs upon atomic weights have appeared containing data of fundamental significance. They may be summarised as follows :

Hydrogen.—W. A. Noyes (*J. Amer. Chem. Soc.*, 1907, 29, 1718) has made complete syntheses of water in five series of determinations. The first series, however, was defective, and is therefore not published by the author. In mean, the four successful series give H = 1·00787, as compared with Morley's figure, 1·00762. The general mean of these values, combined with all other trustworthy determinations, is 1·00779. The rounded-off value, 1·008, is therefore retained in the table.

Chlorine.—Noyes and Weber (*J. Amer. Chem. Soc.*, 1908, **30**, 13) have effected the synthesis of hydrochloric acid, weighing the hydrogen in palladium, the chlorine in potassium chloroplatinate, and also the hydrochloric acid produced by the union of the two elements. From the ratio H : Cl, Cl = 35·458, when H = 1·00779. From the ratio H : HCl, Cl = 35·457.

The same ratios have also been measured by Edgar (*Proc. Roy. Soc.*, 1908, **81**, *A*, 216), but by a different method. The hydrogen, as in former determinations, was weighed in palladium, but the chlorine was prepared by the electrolysis of fused silver chloride, and weighed in the liquid form. The hydrogen chloride was weighed directly in three experiments, and in two others after absorption in water. From the ratio H : Cl, Cl = 35·468. From the ratio H : HCl, Cl = 35·467. With Morley's value for H, the results are nearer Cl = 35·46. Taking all the data together, the value Cl = 35·46 seems to be as near the truth as can be positively asserted now. This includes the former work of Dixon and Edgar, and the density determinations by Guye and Gazarian.

*Sulphur.**—From eighteen determinations of the density of hydrogen sulphide, Baume and Perrot deduce the value S = 32·070. In an earlier investigation by Baume,† who determined the density of sulphur dioxide, he found lower values for S. The figure 32·07, however, is in close agreement with the value obtained by Richards and Jones, when Ag = 107·88, and is doubtless very nearly true.

Lead.—Atomic weight determined by Baxter and Wilson (*Proc. Amer. Acad.*, **43**, 365) from analyses of the chloride. With Ag = 107·93, Pb = 207·19. With Ag = 107·88, Pb = 207·10. This value is still much higher than that previously accepted.

Cadmium.—Blum (*Thesis*, University of Pennsylvania, 1908) has attempted to determine the atomic weight of cadmium by conversion of the oxide into the sulphide. The values obtained range from 112·50 to 112·88, and are admittedly of slight significance.

Tellurium.—In an elaborate memoir upon the atomic weight of tellurium, Baker and Bennett (Trans., 1907, **91**, 1849) give determinations by two new methods. By heating tellurium dioxide with sulphur in such a way that only sulphur dioxide could escape, the ratio TeO_2 to SO_2 was determined. From the mean of twenty-five determinations, Te = 127·609. By direct conversion of tellurium into the tetrabromide, the mean of eighteen determinations was Te = 127·601, when Br = 79·96. Referred to Br = 79·92, this becomes 127 = 54. Several analyses of tellurium tetrachloride, for which the details are not published, gave values for Te between 127·58 and 127·64. On the basis of the modern values for Ag, Cl, and Br, and with due regard to the earlier work of Pellini, Gutbier, Koethner, Norris, Scott, Staudenmaier, and others, the rounded-off figure, Te = 127·5, seems to be fairly acceptable.

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* Private communication from Prof. P. A. Guye.

† *J. Chim. Phys.*, 1908, **6**, 1. Baume also determined the densities of methyl oxide and methyl chloride.

Marckwald,* however, by careful dehydration of telluric acid, found values for Te ranging from 126·65 to 126·94. Six experiments were made, the mean of five, rejecting the lowest of all, being Te = 126·85. This falls below the atomic weight of iodine, and is therefore in harmony with the periodic classification. In view of the general agreement between other investigators in favour of a higher figure, Marckwald's work cannot be accepted without confirmation. The controversy over tellurium is evidently not ended.

Rhodium.—Huttlinger (*Diss.*, Erlangen, 1907), working in Gutbier's laboratory, made three reductions in hydrogen of rhodium pentamine chloride. His results, which seem to be preliminary in character, are practically identical with those obtained by Seubert and Kobbe, whose value for rhodium has been accepted since 1890. No change in this atomic weight is needed.

Palladium.—Woernle (*Sitzungsber. phys. med. Soz. Erlangen*, **38**, 296) made seven analyses of palladosamine chloride: two by reductions in hydrogen, three electrolytically. The mean value obtained was Pd = 106·708, presumably computed with the old figures for N and Cl.

Haas (*Diss.*, Erlangen, 1908), from similar reductions of palladosamine bromide, found Pd = 106·75, calculated with N = 14·037 and Br = 79·953. These determinations, like those of Krell, were made under the direction of Professor Gutbier. The results obtained by Krell, Woernle, and Haas agree well together, and also with Amberg's determinations, and are probably quite accurate. Recomputed, with modern values for N and Cl, Pd = 106·7 very nearly, with an uncertainty of not over 0·05.

Lower values were found by Kemmerer (*Thesis*, University of Pennsylvania, 1908), working under Professor Edgar F. Smith. By reduction in hydrogen, palladosamine chloride gave Pd = 106·399 and

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* *Ber.*, 1907, **40**, 4730. For a criticism of Marckwald, see Baker, *Chem. News*, 1908, **97**, 209.

106·442 as the means of two series of observations. From palladosamine cyanide the value Pd = 106·458 was obtained. The mean of fifteen determinations, taken as one series, gave Pd = 106·434. The more concordant values cited above seem to be more trustworthy, at least so far as present evidence permits us to judge. Kemmerer's computations were made with N = 14·01 and Cl = 35·473.

Europium.—From analyses of the octahydrated sulphate, Jantsch (*Compt. rend.*, 1908, **146**, 473) finds Eu = 152·03, when S = 32·06 and H = 1·008. The round number 152 is retained in the table. This is probably the nearest significant figure.

Erbium.—By repeated fractionation of erbium compounds, Hofmann and Burger (*Ber.*, 1908, **41**, 308) have isolated an oxide of slightly higher molecular weight than that of the old erbia. To the new metal thus indicated they assign the name "neo-erbium," and by synthesis of the sulphate they find its probable atomic weight to be 167·43. The rounded-off figure 167·4 is given provisionally in the table, to stand until more complete data have been obtained.

Ytterbium.—That the old ytterbium is a mixture of two elements has been proved by Urbain (*Compt. rend.*, 1907, **145**, 759, November 4, 1907. See also *Compt. rend.*, 1908, **146**, 406, and *Chem. Zeit.*, 1908, **32**, 730), in Paris, and Auer von Welsbach,* in Vienna, working almost simultaneously and independently. In his earlier paper, Urbain names the two elements "neoytterbium" and "lutecium," with approximate atomic weights of 170 and 174 respectively. In his second memoir, Urbain gives atomic weights for a series of ytterbium fractionations, ranging from 170·6 to 174·02. Welsbach, whose work appeared later than Urbain's, names the two elements "aldebaranium," atomic weight 172·90, and "cassiopeium," atomic weight 174·23. Since Urbain has clear priority, his nomenclature should be preferred, but the atomic weights need to be more sharply determined. Incidentally, Urbain notes that the atomic weight of thulium is lower than 168·5.

Columbium.—A concordant series of determinations made under the direction of Edgar F. Smith † give columbium an atomic weight of 93·5. This is lower than the value hitherto accepted.

Radium.—Thorpe (*Proc. Roy. Soc.*, 1908, **80**, *A*, 298) has redetermined the atomic weight of radium by analyses of the chloride. In mean his determinations, calculated with Ag = 107·88 and Cl = 35·46, give Ra = 226·64. Thorpe, however, gives preference to the determinations by Mme. Curie, who worked with larger quantities of material, regarding his own work as confirmatory. The recalculated value is 226·4.

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* *Monatsh.*, **29**, 181, Feb., 1908. Read before the Vienna Academy, Dec. 19, 1907.

† Private communication. The details are shortly to be published.

In their Report for 1908 this Committee recognised the fact that a general revision of the atomic weight table was desirable, and such a revision has now been made. Modern investigations have shown that the fundamental values required modification, and through them many other atomic weights are affected, although the changes thus brought about are less important than they were generally supposed to be. Many atomic weights remain practically unaltered, and in few instances are the changes large, as a comparison of the new table with its predecessors will show. A careful scrutiny of all the evidence was, however, none the less necessary, and the table now offered gives the results thus obtained.

The fundamental atomic weights, the standards of reference employed in the calculations, are as follows; when O = 16.

H,	1·008.	Br,	79·916.
C,	12·0 0.	Ag,	107·880.
N,	14·007.	K,	39·095.
Cl,	35·460.	S,	32·070.

The value for silver is possibly a trifle too low, by from three to five units in the third decimal place. A combination of the best measurements gives Ag = 107·883. In this case, and in others as well, the second place of decimals is given in the table, the third place being uncertain. Thus we have K, 39·10, N, 14·01, Br, 79·92, etc. Only with hydrogen is the third place retained.

In adjusting the other atomic weights, the determinations by Richards [*] and his colleagues have generally been given preference. They are certainly entitled to the highest weight, but probably not to exclusive consideration. The work of Guye and his associates at Geneva, and the recent direct measurements of the chlorine-hydrogen ratio are also of very great importance. It is to work of this order that we must look for ultimate precision. Important investigations upon atomic weights are now being carried out in several laboratories, and our knowledge of these constants will doubtless become much more exact within the near future.

(Signed) F. W. Clark,
W. Ostwald,
T. E. Thorpe,
G. Urbain.

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[*] An excellent summary of the Harvard work is given by Richards in *J. Chim. Phys.*, 1908, **6**, 92.

1909.

International Atomic Weights.

		O=16.			O=16.
Aluminium	Al	27·1	Molybdenum	Mo	96·0
Antimony	Sb	120·2	Neodymium	Nd	144·3
Argon	A	39·9	Neon	Ne	20
Arsenic	As	75·0	Nickel	Ni	58·68
Barium	Ba	137·37	Nitrogen	N	14·01
Bismuth	Bi	208·0	Osmium	Os	190·9
Boron	B	11·0	Oxygen	O	16·00
Bromine	Br	79·92	Palladium	Pd	106·7
Cadmium	Cd	112·40	Phosphorus	P	31·0
Cæsium	Cs	132·81	Platinum	Pt	195·0
Calcium	Ca	40·09	Potassium	K	39·10
Carbon	C	12·00	Praseodymium	Pr	140·6
Cerium	Ce	140·25	Radium	Ra	226·4
Chlorine	Cl	35·46	Rhodium	Rh	102·9
Chromium	Cr	52·1	Rubidium	Rb	85·45
Cobalt	Co	58·97	Ruthenium	Ru	101·7
Columbium	Cb	93·5	Samarium	Sa	150·4
Copper	Cu	63·57	Scandium	Sc	44·1
Dysprosium	Dy	162·5	Selenium	Se	79·2
Erbium	Er	167·4	Silicon	Si	28·3
Europium	Eu	152·0	Silver	Ag	107·88
Fluorine	F	19·0	Sodium	Na	23·00
Gadolinium	Gd	157·3	Strontium	Sr	87·62
Gallium	Ga	69·9	Sulphur	S	32·07
Germanium	Ge	72·5	Tantalum	Ta	181·0
Glucinum	Gl	9·1	Tellurium	Te	127·5
Gold	Au	197·2	Terbium	Tb	159·2
Helium	He	4·0	Thallium	Tl	204·0
Hydrogen	H	1·008	Thorium	Th	232·42
Indium	In	114·8	Thulium	Tm	168·5
Iodine	I	126·92	Tin	Sn	119·0
Iridium	Ir	193·1	Titanium	Ti	48·1
Iron	Fe	55·85	Tungsten	W	184·0
Krypton	Kr	81·8	Uranium	U	238·5
Lanthanum	La	139·0	Vanadium	V	51·2
Lead	Pb	207·10	Xenon	Xe	128
Lithium	Li	7·00	Ytterbium (Neoytterbium)	Yb	172
Lutecium	Lu	174	Yttrium	Y	89·0
Magnesium	Mg	24·32	Zinc	Zn	65·37
Manganese	Mn	54·93	Zirconium	Zr	90·6
Mercury	Hg	200·0			

Of the following papers, those marked * were read :

*1. "Organic derivatives of silicon. Part IX. Experiments on the resolution of *dl*-benzylethylpropyl*iso*butylsilicanesulphonic acid." By Frederic Stanley Kipping and Harold Davies.

dl-*Benzylethylpropyl*iso*butylsilicane*, $SiEtPr(C_4H_9)\cdot CH_2Ph$, a liquid boiling at 282—283°, has been prepared by treating benzylethylpropylsilicyl chloride (Kipping, *Trans.*, 1907, **91**, 717) with magnesium *iso*butyl bromide ; when treated with chlorosulphonic acid, it gives a monosulphonic derivative, which is isolated in the form of its *l*-menthylamine salt.

l-*Menthylamine* dl-*benzylethylpropyl*iso*butylsilicanesulphonate*,

$$SiEtPr(C_4H_9)\cdot CH_2\cdot C_6H_4\cdot SO_3H,C_{10}H_{21}N,2H_2O,$$

separates from moist light petroleum in lustrous leaflets, and, when dehydrated, melts at 127—128° ; it is very similar in its properties to the corresponding salts of benzylmethylethylpropylsilicanesulphonic acid (*loc. cit.*) and of benzylethyldipropylsilicanesulphonic acid (Marsden and Kipping, *Trans.*, 1908, **93**, 205), although the latter is not a *dl*-compound.

The *strychnine*, *brucine*, *cinchonidine*, *quinine*, and *cinchonine* salts of the *dl*-acid and the corresponding hydrogen alkaloidal salts of the last-named three bases have been prepared ; these eight compounds were systematically crystallised under various conditions, but in all cases, except in that of the cinchonine hydrogen salt, the melting or decomposing points and the specific rotations of the extreme fractions of a given salt were identical. The cinchonine hydrogen salt gave fractions having the same decomposing points, but differing widely in specific rotation ; whether this difference is due to a resolution of the acid or not is still an open question.

*2. "The crystallisation of externally compensated mixtures." By Frederic Stanley Kipping and William Jackson Pope.

The recent publication of Ostromisslensky's paper (*Ber.*, 1908, **41**, 3035) on this subject affords an occasion for briefly recording the results of some work commenced in 1898, but which has not been brought to a definite issue.

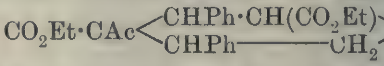
On crystallising *dl*-sodium ammonium tartrate (prepared from purified racemic acid) from aqueous solutions of dextrose, and then recrystallising the deposit, the product consisted, in nearly all cases, of the *d*-tartrate, almost or entirely free from the *l*-salt (*Proc.*, 1898, **14**, 113).

It is now shown that similar results are obtained in absence of dextrose even when the racemic acid, used in the preparation of the sodium ammonium salt, has been repeatedly crystallised from water. This preferential deposition of the *d*-tartrate may be due to the seeding of the solutions by laboratory dust, or to the presence of a minute excess of the *d*-acid in the racemic acid employed; the results obtained on fractionally crystallising commercial racemic acid itself seem to show that the complete removal of extremely small quantities of dextrorotatory impurity is a very difficult matter.

*3. "Formation of *cyclo*hexanone derivatives from olefinic compounds." By Siegfried Ruhemann.

Although the esters of acetylenic acids form additive products with phenols, olefinic monocarboxylic esters or olefinic monoketones do not unite with sodium phenoxide. Condensation, however, takes place if the number of electronegative groups in an olefinic compound is increased. The additive compound of ethyl benzylideneacetoacetate with sodium phenoxide at once condenses, thus:

$$2CHPh(OPh)\cdot CHAc\cdot CO_2Et = C_{26}H_{28}O_6 + 2C_6H_5\cdot OH,$$

yielding a compound, $C_{26}H_{28}O_6$, which has twice the molecular formula of ethyl benzylideneacetoacetate. The substance is regarded as a *cyclo*hexanone derivative,  $CO_2Et\cdot CAc{<}\begin{matrix}CHPh\cdot CH(CO_2Et)\\ CHPh\text{———}CH_2\end{matrix}{>}CO$, and this constitution is supported by a number of facts which the closer study of the reaction has furnished.

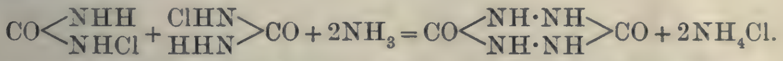
Similar *cyclo*hexanone derivatives have been obtained by the action of sodium phenoxide on benzylideneacetylacetone, $CHPh{:}CAc_2$, and ethyl ethylideneacetoacetate, $CHMe{:}CAc\cdot CO_2Et$.

On the other hand, but in harmony with the above view of the formation of these *cyclo*hexanone compounds, neither ethyl benzylidenemalonate, $CHPh{:}C(CO_2Et)_2$, nor ethyl benzylidenebenzoylacetate, $CHPh{:}CBz\cdot CO_2Et$, condenses to cyclic compounds, although uniting with sodium phenoxide.

*4. "Synthesis of para-urazine from carbamide." By Frederick Daniel Chattaway.

By means of dichlorocarbamide, $NHCl\cdot CO\cdot NHCl$, recently described by the author (*Proc. Roy. Soc.*, 1908, **81**, *A*, 381), carbamide can be very simply converted into *p*-urazine, which has hitherto only been obtained by the employment of hydrazine. All that is necessary is to add an aqueous solution of dichlorocarbamide to a strong solution of ammonia, when *p*-urazine, which is very sparingly soluble in water, separates as a white, crystalline precipitate.

In the reaction, one of the chlorine atoms of the dichlorocarbamide is probably replaced by hydrogen, two molecules of the resulting monochlorocarbamide then condensing under the influence of the ammonia, thus:



$$\mathrm{CO}<\begin{matrix}\mathrm{NHH}\\ \mathrm{NHCl}\end{matrix} + \begin{matrix}\mathrm{ClHN}\\ \mathrm{HHN}\end{matrix}>\mathrm{CO} + 2\mathrm{NH_3} = \mathrm{CO}<\begin{matrix}\mathrm{NH\cdot NH}\\ \mathrm{NH\cdot NH}\end{matrix}>\mathrm{CO} + 2\mathrm{NH_4Cl}.$$

p-Urazine is readily hydrolysed when heated with concentrated sulphuric acid, carbon dioxide and hydrazine sulphate being produced, thus: $C_2H_4O_2N_4 + 2H_2O + 2H_2SO_4 = 2CO_2 + 2NH_2\cdot NH_2,H_2SO_4$. This reaction furnishes a very simple method for the preparation of small quantities of hydrazine.

DISCUSSION.

Dr. HEWITT called attention to the analogy between Dr. Chattaway's process for obtaining hydrazine and the method devised by Raschig, namely, the direct action of hypochlorites on ammonia.

*5. "Chlorine derivatives of substituted carbamides." By Frederick Daniel Chattaway and Donald Frederick Sandys Wünsch.

The action of chlorine on carbamide should give rise to a monochloro-, a symmetrical and an unsymmetrical dichloro-, a trichloro-, and a tetrachloro-carbamide. Of these, only the *s*-dichloro-derivative has so far been isolated. The action of chlorine on a number of substituted carbamides has been studied, and it has been shown that in such compounds it is possible to replace by chlorine all the hydrogen attached to nitrogen, atom by atom.

Compounds of the types $NHR\cdot CO\cdot NHCl$, $NClR\cdot CO\cdot NHCl$, $NClR\cdot CO\cdot NCl_2$, $NClR\cdot CO\cdot NClR$, and $NR_2\cdot CO\cdot NCl_2$ have been obtained, R being an acyl or an alkyl group.

The monochloroacylcarbamides are beautifully crystalline solids, which are among the most stable of the nitrogen chlorides known. The acyl compounds containing more chlorine, and most of those containing an alkyl group, are liquids which decompose easily on heating.

Nearly all of the possible chlorine derivatives of acetyl-, benzoyl-, methyl-, *s*- and *as*-dimethyl-, ethyl-, *s*-diethyl-, and benzyl-carbamide have been prepared.

It is thus proved that in carbamides the replacement of one hydrogen atom by chlorine does not prevent in any way the replacement of the second hydrogen atom attached to the same nitrogen.

There is every reason, therefore, to believe that the action of chlorine on carbamide itself gives rise to the other theoretically possible chlorocarbamides, and that these will be obtained when the conditions under which they can exist are ascertained, and when the difficulties attending their isolation have been overcome.

*6. "Chemical examination of Eriodictyon. Part II."

By Frank Tutin and Hubert William Bentley Clewer.

Eriodictyon leaves were shown by Power and Tutin (*Proc. Amer. Pharm. Assoc.*, 1906, **54**, 352) to contain, in addition to other compounds, three new, crystalline substances of a phenolic nature, namely, eriodictyol, $C_{15}H_{12}O_6$ (m. p. 267°), homoeriodictyol, $C_{16}H_{14}O_6$ (m. p. 223°), and a third substance, possessing the formula $C_{16}H_{12}O_6$, which occurred only in very small amount.

The present authors have employed a larger amount of the extract of *eriodictyon* leaves, and, after a prolonged process of separation, have isolated a larger amount of the last-mentioned compound, together with two new substances.

Chrysoeriol, $C_{16}H_{12}O_6$, the substance previously isolated in small amount, forms golden-yellow leaflets, and does not melt at 337°. It contains three hydroxyl groups, and yields *triacetylchrysoeriol*,

$$C_{16}H_9O_6(CO\cdot CH_3)_3,$$

which melts at 211—212°.

Xanthoeridol, $C_{18}H_{14}O_7$, crystallises in yellow needles melting at 258°. *Triacetylxanthoeridol*, $C_{18}H_{11}O_7(CO\cdot CH_3)_3$, melts at 175—176°.

Eriodonol, $C_{19}H_{18}O_7$, separates from dilute alcohol in pale yellow needles, which contain one molecule of water of crystallisation and melt at 199°; the anhydrous substance melts at 209°. It yields a *tetra-acetyl* derivative melting at 131°.

*7. "The hydration of precipitates." By Spencer U. Pickering.

Many substances which are precipitated from aqueous solution are capable of emulsifying oils, and, by adjusting the amount of oil in the emulsion, the latter may be obtained of the same density as the liquid. By determining the density of this liquid, the density of the oil, and that of the precipitate in the anhydrous conditions, and by ascertaining the weight of oil required to float a given weight of precipitate in two liquids of different densities, the weight of water combined with the anhydrous precipitate may be determined. The precipitate selected was the compound $10CuO,SO_3,CaSO_4,Na_2SO_4$, which is of uniform composition when thrown down by adding lime-water to copper sulphate in the presence of varying quantities of sodium sulphate. The amount of water combined with it was found to be about $42H_2O$. It was also ascertained that the water possessed the same specific gravity of ice, as in the case of the water of crystallisation of most hydrated salts.

DISCUSSION.

The PRESIDENT called attention to the fact that Dr. Chichester Bell had, more than ten years ago, made experiments on the velocity of sound in melted ice at $+0{\cdot}5°$, and in cooled water at the same temperature. The velocities appeared to differ. Experiments by Dr. Wilsmore, unpublished, on the density of melted ice, and of cooled water, were indecisive, owing to the lapse of time before an accurate density could be determined.

He also reminded Mr. Pickering that Playfair and Joule had concluded from their experiments that "water of crystallisation" has the same molecular volume as ice.

*8. "Studies of dynamic isomerism. Part VIII. The relationship between absorption spectra and isomeric change. Absorption spectra of halogen, nitro-, and methyl derivatives of camphor." By Thomas Martin Lowry and Cecil Henry Desch.

The band noted by Baly and by Hartley in the ultra-violet absorption spectrum of camphor at a concentration of $N/10$ appears also in the spectrum of β-bromocamphor; in both cases the band is weakened by diluting to $N/100$, but is restored by the addition of alkali. A similar band of rather greater intensity is seen in the spectrum of α-bromocamphor at a concentration of $N/100$; as this band is developed by neutral solutions in which the α-bromo-compound is stable, and is only slightly intensified when a condition of equilibrium between isomerides is set up by the addition of alkali, its appearance cannot well be associated with the occurrence of reversible isomeric change.

No marked change is seen in the absorption spectrum of α-bromocamphor when a halogen is introduced into the β- or π-position, but the band is no longer developed when the second α-hydrogen atom is displaced by a halogen or by a nitro-group; it may therefore be associated with the presence of a displaceable hydrogen atom in the group $-CHX{\cdot}CO-$, although not dependent on any actual transference of the atom; α'-bromo-α-methylcamphor appears, however, to produce a shallow band.

The weak band of nitrocamphor is greatly intensified by alkalis, but does not appear in the spectrum of the anhydride derived from the pseudo-form; it is therefore dependent on the presence of a displaceable hydrogen atom rather than on the occurrence of a pseudo-nitro-structure. The β- and π-bromo-derivatives behave like nitrocamphor, but the α-halogen derivatives, which do not undergo isomeric change in solution, produce no absorption band. Nitrocamphane does not give rise to a band either alone or in presence of alkali.

9. "The relationship between the constitution and the absorption spectra of pyridine and various derivatives." By John Edward Purvis.

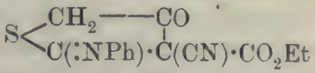
The absorption bands of 3 : 5-dichloropyridine, two isomeric trichloropyridines, two isomeric tetrachloroaminopyridines, α-picoline and several of its derivatives, 2 : 4 : 6-trimethylpyridine and several of its derivatives, and chlorolutidine have been investigated.

The results showed that: (1) the general effect of introducing atoms or groups of atoms into the nucleus is to increase the persistence of the absorption band as well as to shift it towards the red end of the spectrum, whilst when they are introduced into the side-chains they generally decrease the persistence. (2) The weighting of the nucleus does not, however, always mean that the absorption band is shifted towards the red end. The type and the spatial position of the introduced atoms or groups are factors in determining the absorption. (3) In isomeric substances, the spatial positions of the substituting atoms in the nucleus are of considerable importance in influencing the position and the persistence of the absorbed rays. (4) The substitution of atoms in the side-chains does not exert the same marked influence as when they are substituted in the nucleus. (5) The addition of hydrochloric acid to 2 : 4 : 6-trimethylpyridine and α-picoline (as well as to pyridine and lutidine) exerts a marked influence on the vibrations of the nucleus, and the effect is very similar to that produced when chlorine atoms are introduced into the nucleus.

Considerations on the influence of the changing valency of the nitrogen atom and other conditions in explanation of these facts were discussed.

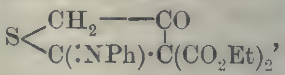
10. "The action of mustard oils on the ethyl esters of malonic and cyanoacetic acids. Part II." By Siegfried Ruhemann.

The author showed that each of the cyclic compounds:



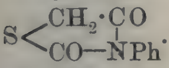
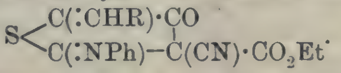
$$S\left<\begin{array}{l}CH_2\text{——}CO\\ C(:NPh)\cdot C(CN)\cdot CO_2Et\end{array}\right.$$

(I.)



$$S\left<\begin{array}{l}CH_2\text{——}CO\\ C(:NPh)\cdot C(CO_2Et)_2\end{array}\right.,$$

(II.)

which he described recently (*Trans.*, 1908, **93**, 621) as existing in two modifications, namely, a yellow and a colourless one, only occur in one form. He was led to this result in the course of a comparative study of these substances, and the similarly constituted compound:  $\mathrm{S}{<}\begin{array}{l}\mathrm{CH_2\cdot CO}\\ \quad\quad\ \ |\\ \mathrm{CO{-}NPh}\end{array}$. Like the latter, the yellow cyclic compound (I) (and also II) condenses with aldehydes with the formation of compounds of the general formula  $\mathrm{S}{<}\begin{array}{l}\mathrm{C(:CHR)\cdot CO}\\ \quad\quad\quad\quad\quad\ |\\ \mathrm{C(:NPh){-}C(CN)\cdot CO_2Et}\end{array}$. It was found that the same products were formed from the colourless compound, and this fact led to the view that both specimens of (I) were identical. The author was able to verify this conclusion.

11. "The interaction of hydrogen and chlorine."

By David Leonard Chapman and Patrick Sarsfield MacMahon.

The authors have shown that the statement of Bunsen and Roscoe, that the rate of photochemical action between chlorine and hydrogen in a mixture containing equivalent amounts of these gases is reduced by the addition of a small volume either of hydrogen or chlorine, cannot be substantiated. Hydrogen and chlorine prepared by the electrolysis of concentrated hydrochloric acid do not possess the alleged inhibitive influence if sufficient precautions are taken to exclude air. It is considered likely that the hydrogen used by Bunsen and Roscoe contained oxygen. This is the more probable, as the gas employed by them was prepared by the electrolysis of dilute sulphuric acid.

12. "Nitrogen chloride."

By David Leonard Chapman and Leonard Vodden.

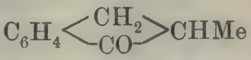
The authors have shown by a direct analysis that the amount of hydrogen contained in the vapour of nitrogen chloride prepared by the action of chlorine on a neutral solution of ammonium chloride is inappreciable. In harmony with this result, the ratio of nitrogen to chlorine is found to agree very closely with the formula NCl_3. Gattermann's conclusion that the freshly-prepared chloride contains hydrogen which can only be replaced by the continued action of chlorine is therefore called in question.

A method by which the ammonium chloride resulting from the hydrolysis of nitrogen chloride with hydrochloric acid can be isolated without the aid of a reducing agent was described. The method affords the first entirely satisfactory demonstration of the reversibility of the change expressed by the equation:

$$NH_4Cl + 3Cl_2 = NCl_3 + 4HCl.$$

13. "The atmospheric oxidation of β-methylhydrindone."

By Arthur Henry Salway and Frederic Stanley Kipping.

β-Methylhydrindone,  $C_6H_4\left<\begin{matrix}CH_2\\CO\end{matrix}\right>CHMe$ (Kipping and Clarke, *Trans.*, 1903, **83**, 913), is slowly oxidised on exposure to the air, giving a mixture of compounds from which acetic, phthalic, and benzylmethylketone-*o*-carboxylic acid, $CH_3{\cdot}CO{\cdot}CH_2{\cdot}C_6H_4{\cdot}CO_2H$, may be isolated; a small amount of a neutral compound, melting at 211°, is also present in the crude oxidation product.

It is suggested that the ketonic form of methylhydrindone (compare Kipping, *Proc.*, 1902, **18**, 34) first undergoes change to the enolic modification, which then combines directly with a molecule of oxygen in much the same way as unsaturated compounds combine with a molecule of ozone; this additive product is then decomposed by water, giving benzylmethylketone-*o*-carboxylic acid, and by similar processes the latter is oxidised to phthalic and acetic acids.

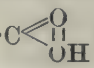
14. "A glucoside from Tephrosia purpurea." (Preliminary note.)

By George Clarke, jun., and S. C. Banerjee.

Tephrosia purpurea, Pers. (nat. ord. *leguminosae*), a small woody annual, grows luxuriantly during the monsoon in many waste tracts of the United Provinces of Agra and Oudh. The leaves yield a crystalline glucoside on extraction with either ethyl alcohol or acetone, and subsequently treating the evaporated extract with water and light petroleum to separate tar. The yield from one extraction is approximately 2 per cent. on the dried leaves. The glucoside melts and decomposes at 180—185° (uncorr.), and on hydrolysis with dilute sulphuric acid yields quercetin and dextrose. It appears, therefore, to be identical with osyritrin (A. G. Perkin, *Trans.*, 1897, **71**, 1134).

15. "Note on the constitution of the carboxyl group."

By Ida Smedley.

From a consideration of the physical and chemical properties of the carboxylic acids, the constitution  $\cdot C\left<\begin{matrix}O\\ \| \\ OH\end{matrix}\right.$ is suggested for the carboxyl group as better representing its physical and chemical behaviour.

16. "The relation between the chemical constitution and optical properties of the aromatic α- and γ-diketones." By Ida Smedley.

Yellow *s*-dibenzoylethylene (m. p. 111°) was prepared by condensing benzoylformaldehyde with acetophenone in the presence of acetic anhydride. This compound is identical with that obtained by Paal and Schulze (*Ber.*, 1900, **33**, 3784) by the action of heat on dibenzoylmalic acid. From a consideration of the solubility, melting point, refractive power, and colour of the *cis*- and *trans*-isomerides, the yellow form, which has the greater solubility, lower melting point, and greater refraction, is regarded as the *cis*-isomeride, and not the *trans*-form as suggested by Paal and Schulze. These two forms furnish the first instance described of a marked difference in the refraction of *cis*- and *trans*-isomerides. The molecular refractions of the following compounds were measured: phenyl methyl diketone ($M_\alpha = 41{\cdot}32$), benzoylformaldehyde ($M_\alpha = 36{\cdot}99$), *cis*-dibenzoylethylene (m. p. 111°; $M_\alpha = 73{\cdot}96$), *trans*-dibenzoylethylene (m. p. 134°; $M_\alpha = 71{\cdot}84$), *cis*-dibenzoylphenylethylene ($M_\alpha = 99{\cdot}57$), *cis*-dibenzoyldiphenylethylene ($M_\alpha = 122{\cdot}76$), *trans*-dibenzoyldiphenylethylene ($M_\alpha = 123{\cdot}71$). The evidence from a consideration of their refractive power is applied to determine the constitution of the α-diketones and *s*-diacylethylenes. Marked similarities are shown in the behaviour of these two classes of compounds.

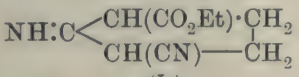
17. "The transformation of aliphatic nitriles into alicyclic imino-compounds." (Preliminary note.) By Jocelyn Field Thorpe.

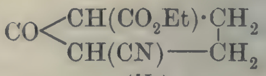
For some time past, experiments have been in progress having for their object the study of the conditions under which aliphatic dinitriles having the nitrile groups separated by two, three, four, etc., carbon atoms pass into the corresponding alicyclic imino-compounds.

Preliminary experiments indicate that there is a greater tendency to form a three-carbon ring in this manner than a ring of four carbon atoms, but that the *cyclo*pentane ring is produced with most remarkable ease.

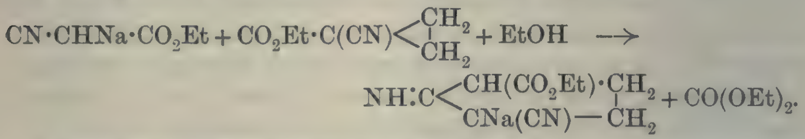
Thus, during some experiments on the formation of the *cyclo*propane ring by the interaction of ethyl sodiocyanoacetate and ethylene dibromide, Carpenter and Perkin (*Trans.*, 1899, **75**, 921) isolated, as a by-product, a substance which melted at 119·5°, and to which they assigned the formula $CN{\cdot}CH_2{\cdot}CH_2{\cdot}CH_2{\cdot}CH(CN){\cdot}CO_2Et$ (ethyl αδ-dicyanovalerate), owing to the fact that it yielded adipic acid on hydrolysis with alkaline hydrolysing agents.

It is now found that this substance is ethyl 2-imino-3-cyano*cyclo*pentane-1-carboxylate (I), and that it is immediately converted by the action of cold concentrated hydrochloric acid into ethyl 3-cyano*cyclo*pentan-2-one-1-carboxylate (II):


(I.)


(II)

Ethyl 2-*imino*-3-*cyano*cyclo*pentane*-1-*carboxylate* can be produced in almost theoretical yield by the interaction of ethyl sodiocyanoacetate and ethyl 1-cyano*cyclo*propane-1-carboxylate in alcoholic solution, the sole products of the reaction being the sodium compound of the imino-compound and ethyl carbonate; the equation representing the initial and final products of the reaction is therefore as follows:



A similar condensation product is obtained when ethyl sodiomalonate is substituted for ethyl sodiocyanoacetate in the above equation. The investigation of the properties of these cyclic ketones is in progress.

18. "Action of alcohols on metallic calcium."
By Frederick Mollwo Perkin and Lionel Pratt.

When calcium is added to alcohols reaction ensues and the alkyloxide, $Ca(OAlk)_2$, is produced (*Proc.*, 1907, **23**, 304). The reaction, however, is generally slow, but is greatly facilitated by heat. Calcium hydride reacts more readily than metallic calcium, but the product is less pure than when the metal is employed, owing to impurities in the calcium hydride. Calcium ethoxide is soluble in ethyl alcohol, and crystallises with two molecules of alcohol of crystallisation. Other alkyloxides are not so readily prepared, owing to their insolubility in the alcohols. Calcium ethoxide has been employed satisfactorily for organic condensations in place of sodium ethoxide.

19. "The condensation of oxymethylenecamphor with primary and secondary amino-compounds." By William Jackson Pope and John Read.

On condensing externally compensated *a*-phenylethylamine with *d*-oxymethylenecamphor, two stereoisomeric products are obtained, one from each of the optically active components of the primary base; a method is thus indicated for ascertaining whether a particular primary amino-compound is or is not externally compensated. The two products exhibit marked mutarotation, and this is attributed to their conversion in solution into isodynamic mixtures.

d-Oxymethylenecamphor itself and its condensation products with aniline, *p*-toluidine, and *β*-naphthylamine exhibit mutarotation in various solutions and this is again attributed to isodynamic change.

20. “Note on the variation in the catalytic activity of mineral acids with changes in their concentration.” By Arthur Lapworth.

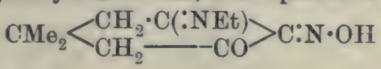
Several recent investigations (Senter., *Trans.*, 1908, **91**, 467: Stieglitz, *Amer. Chem. J.*, 1908, **39**, 29 *et seq.*; Acree and others, *Ber.*, 1908, **41**, 3214 *et seq.*) suggest that during certain changes, in which electrolytes are concerned, not only simple and complex ions are directly concerned, but that intramolecular changes in, and interactions between, non-ionised substances may occur, and sometimes even to the extent of being a necessary part of the process.

The author recently referred to such a possibility in the case of esterification as accelerated by an acid (*Trans.*, 1908, **93**, 2196, 2197), inferring that the disproportionate increase in the velocity with increase in the amount of mineral acid may possibly be due to a secondary reaction of this nature. It is necessary to state that the discussion applied only to those cases where no relatively powerful base is present in such small quantity that this decreases rapidly on addition of mineral acid, as might conceivably be the condition in alcohol containing only a very little water; the general case, however, comes under the discussion mentioned, and, as has long been recognised, is doubtless intimately connected with neutral salt action.

Attention must also be drawn to the fact that the expression for $\frac{1}{2}\frac{d^2(H^2)}{dA^2}$ (*not* $\frac{d^2(H^2)}{dA^2}$: *loc. cit.*, p. 2197), which indicates the direction of change in relative quantity of non-ionised compounds with alteration in the amount of catalyst, is always positive, this not being limited even by the condition suggested.

21. “The condensation of dimethyldihydroresorcin with ethylamine.” By Paul Haas.

By the action of nitrous acid on the condensation product of ethylamine with dimethyldihydroresorcin, a compound of the constitution



$$\mathrm{CMe_2}<\begin{matrix}\mathrm{CH_2\cdot C(\colon NEt)}\\ \mathrm{CH_2\text{———}CO}\end{matrix}>\mathrm{C\colon N\cdot OH}$$

is produced.

This substance crystallises from water with two molecules of the solvent, and has a very intense carmine colour; when dried in a vacuum it becomes anhydrous, and is then dark blue.

ANNIVERSARY DINNER.

It has been decided by the Council to arrange for a Dinner of the Fellows of the Society and their friends, to be held at the Whitehall Rooms on Thursday, March 25th, 1909, this being the day fixed for the Annual General Meeting. Further particulars will be announced shortly.

ERRATA.

PROCEEDINGS, 1908.

Page.	Line.	
274	7	*for* "hypoiodate" *read* "hypoiodite."
280	20	title should be "**Silicon researches. Part XIII. Silicon halides and pyridine, acetonitrile, etc.**"

At the next Ordinary Meeting on **Thursday**, February **4th**, 1909, at **8.30** p.m., the following papers will be communicated :

"The triazo-group. Part VII. Interaction of benzhydroximic chloride and sodium azide." By M. O. Forster.

"The triazo-group. Part VIII. Azoimides of the monobasic aliphatic acids." By M. O. Forster and R. Müller.

"Nitro-derivatives of ortho-xylene." By A. W. Crossley and Miss Nora Renouf

"The divergence of the atomic weights of the lighter elements from whole numbers." By A. C. G. Egerton.

"Benzyl and ethyl derivatives of silicon tetrachloride." By G. Martin and F. S. Kipping.

"The constituents of the bark of *Prunus Serotina*. Isolation of l-mandelonitrile glucoside." By F. B. Power and C. W. Moore.

"The mechanism of the reduction of nitroanilines and nitrophenols." By B. Flürscheim.

"The relation between the strength of acids and bases, and the quantitative distribution of affinity in the molecule." By B. Flürscheim.

"A simple notation for indicating the configuration of the sugars and allied substances." By T. S. Patterson.

"Note on the determination of the rate of chemical change by measurement of the gases evolved." By F. E. E. Lamplough.

"The formation and reactions of imino-compounds. Part VIII. The formation of methyl derivatives of 1 : 3-diamino-2-phenylnaphthalene from the three tolylacetonitriles." By S. R. Best and J. F. Thorpe.

"The effect of conjugated unsaturated groups on optical activity. Part I." By T. P. Hilditch.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 13/2/09

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 25. No. 351.

Thursday, February 4th, 1909, at 8.30 p.m., SIR WILLIAM RAMSAY, K.C.B., F.R.S., President, in the Chair.

Mr. F. Williams was formally admitted a Fellow of the Society.

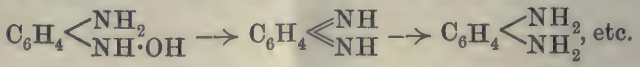
Certificates were read for the first time in favour of Messrs.:

Howard Alfred Caulkin, B.Sc., Oaklands, Solihull, Warwickshire.
John Henry Chew, 46, Lytham Road, Blackpool.
George Clarke, Cawnpore, U.P., India.
George Stanley Cooper, Heaton House, Cleckheaton, Yorks.
William Fowler, 3, Cranbrook Road, Victoria Docks, E.
Egerton Hargreaves, M.Sc., "Arthog," Garner's Lane, Davenport.
Reginald Hopkinson, B.Sc., Brimington House, Brimington.
Floyd J. Metzger, Columbia University, New York City, U.S.A.
Oswald John Dalgatty Thomas, 65, Clarendon Gardens, Ilford.
Vernon James Tilley, "Linthorpe," Becmead Avenue, Streatham, S.W.
Charles William Truelove, B.Sc., 17, Tylney Road, Forest Gate, E.
Robert William Wilson, 2, Parade, Aldersbrook Road, Manor Park, E.

Of the following papers, those marked * were read:

*22. "The mechanism of the reduction of nitroanilines and nitrophenols." By Bernhard Flürscheim.

Flürscheim and Simon have shown recently that 2 : 4-dinitrodiphenylamine, on reduction by stannous chloride, only yields the amine under conditions which cause the azoxy-derivative to be formed in the case of all the other dinitro-compounds examined. Similar observations in alkaline solutions had led Elbs to assume the following changes during the reduction of *o*- and *p*-nitroaniline and phenols:



$$\mathrm{C_6H_4}{<}\begin{matrix}\mathrm{NH_2}\\\mathrm{NH{\cdot}OH}\end{matrix} \longrightarrow \mathrm{C_6H_4}{\ll}\begin{matrix}\mathrm{NH}\\\mathrm{NH}\end{matrix} \longrightarrow \mathrm{C_6H_4}{<}\begin{matrix}\mathrm{NH_2}\\\mathrm{NH_2}\end{matrix}, \text{ etc.}$$

According to the views on substitution in aromatic compounds put forward by the present author, it seemed possible that, condensation to the azoxy-derivative being due to the residual affinity of the tervalent nitrogen in the hydroxylamine and nitroso-compounds, partial saturation of that residual affinity through the influence of an ortho- or para-amino- or hydroxyl group might prevent such condensation.

To decide this question, the behaviour of 2 : 4-dinitrodiphenylmethylamine was examined, intramolecular change being here excluded. It was found that, in this case also, no azoxy-compound, but only the amine, is formed. Experimental evidence, therefore, favours the second of the above hypotheses.

*23. "The relation between the strength of acids and bases and the quantitative distribution of affinity in the molecule." By Bernhard Flürscheim.

It has been frequently observed that introduction of acidic or basic radicles into the molecule of an acid does not necessarily affect the dissociation constant in the expected sense, but often in the opposite direction. The author suggests the following hypothesis in explanation of this: The dissociation constant of an acid is inversely proportional to the strength of the bond between the acidic radicle and hydrogen, and directly proportional to the strength of the linking between the acidic radicle and the negative electron. The latter depends on the more or less negative nature of the acidic radicle; the former, however, is chiefly a function of the amount of affinity which the atom to which hydrogen is linked can place at the hydrogen's disposal. This amount is variable, and its order of magnitude can in each particular case be foreseen by the application of general views previously advanced by the author.

Similarly, quaternary ammonium hydroxides and analogous derivatives of oxygen, sulphur, iodine, etc., even when negatively substituted, may be strong electrolytes, because quinquevalent nitrogen can only weakly attract the hydroxyl group. Lastly, the salts of amines, etc., with acids are hydrolysed more readily when the nitrogen is linked to unsaturated atoms which absorb much of its affinity. A consideration of many affinity constants, hitherto thought abnormal, confirms these views, which have also been experimentally supported by the discovery that, when the basic group ·NMePh is introduced in the ortho-position with respect to the amino-group of *m*-nitroaniline, the basicity of the latter is very considerably reduced.

*24. "Note on the determination of the rate of chemical change by measurement of the gases evolved." By Francis Edward Everard Lamplough.

In a criticism of the author's work on this subject, J. C. Cain and F. Nicoll (*Proc.*, 1908, **24**, 282) have contended that the solutions of diazobenzene chloride, the rate of decomposition of which was being determined by them from the rate of evolution of nitrogen, did not become supersaturated by the gas, and that no error was thereby introduced into their results.

With regard to the statements of Cain and Nicoll, it is manifest that their treatment of the solution (shaking, etc.) *before* measurement could not possibly prevent supersaturation occurring whilst measurement was taking place. Secondly, the ultimate evolution of the calculated volume of gas from the solution is merely evidence that the condition of supersaturation is only a temporary one. This would be expected of a metastable state, and is fully shown to be the case from the author's experiments.

A very simple direct experiment is, however, the most convincing proof that their reasoning is inadmissible. If a solution of diazobenzene chloride, prepared in the usual manner and rapidly heated with or without shaking, say, to 50°, is allowed to stand for ten or fifteen minutes and the flask then gently revolved so as to set the liquid in fairly rapid rotation, a copious effervescence will at once be seen to result. The effect is still more clearly shown if the flask is connected to a pneumatic trough, in which case the liquid may be well agitated by shaking.

Experiments were made by the author which showed that under conditions of efficient stirring no acceleration of the reaction was produced by "colloidal" platinum. This is not surprising in view of the immediate precipitation of the metal from the colloidal state in the presence of the strong electrolytes contained in the solution.

In throwing doubt on the measurement of temperature, Cain and Nicoll appear entirely to have overlooked the experiment (*Proc. Camb. Phil. Soc.*, 1908, **14**, 590) by which it is proved that, throughout the time of measurement, the temperature of the reacting liquid did not differ more than 0·1° from that of the water-bath. A few words of a sentence from the author's paper are quoted apart from the context by Cain and Nicoll, so that they produce an entirely incorrect impression as to the actual procedure.

Finally, no suggestion of errors in temperature measurements could possibly dispose of the obvious conclusions from the comparative experiments performed with and without stirring at the same temperature and in the presence of the same platinum stirrer. In the experiments *with* agitation of the solution, the gas was at first evolved with high velocity, and this rate gradually diminished, strictly following the unimolecular law. In those *without* agitation, the rate of evolution was at first slow, gradually increased to a maximum value, and then diminished; if the stirrer was set in motion at any time in such an experiment, the immediate evolution of the large quantity of stored-up gas indicated a degree of supersaturation up to 100 times the volume normally dissolved. Again, in the experiments with stirring, the values of the velocity constant from first to last showed only very slight and irregularly-distributed differences from the mean value; in the experiments without stirring, and in those of Cain and Nicoll, at best only a limited range from the middle of the experiment could be selected over which the calculated values of the "constant" (much lower than those of the experiments with stirring) might be plausibly uniform.

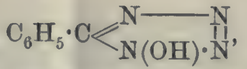
DISCUSSION.

Dr. VELEY remarked, with reference to the author's statement as to the rate of decomposition of oxalic by sulphuric acid, that it appeared unreasonable, if not romantic, to criticise work which he, the speaker, had never done, and conclusions at which he had never arrived.

From calculations made in a number of cases in which a gas is evolved from a solution by a process of chemical change, it appeared that the author had very greatly overestimated the supersaturation value as at 100, or even more; it probably did not exceed 8 to 12, according to the nature of the gas and conditions of experiment.

Mr. LAMPLOUGH, in reply, pointed out that Euler performed his one comparison experiment with and without stirring at 25°. At this temperature the velocity of the reaction would be 100 times less, and the solubility of nitrogen only twice greater, than at the temperature of his (the speaker's) comparison experiment then under consideration, and a much closer agreement would therefore be expected. The author had hitherto confined his attention to the benzenediazonium compounds, and these had been investigated at temperatures from 36° to 67°. Mr. Lamplough offered apologies to Dr. Veley for the incorrect statement that he (Dr. Veley) had shown the decomposition of oxalic acid by sulphuric acid to be bimolecular. It should rather have been said that Dr. Veley found that the decomposition of formic acid by sulphuric acid was bimolecular, but had arrived at no conclusion from his experiments with oxalic acid (*Phil. Trans.*, 1888, **178**, 280, 291). Both these actions had since been shown to be unimolecular, the former by the author, the latter by Lichty, of Heidelberg, by a titration method. He further pointed out that his method of determining the degree of supersaturation was not theoretical, but practical, and confirmed his assertion as to the high degrees of supersaturation obtained by showing from the curves of an actual experiment that 37 c.c. of solution at 62° held at one time 21 c.c. of gas, which from the value 0·006 for the solubility of nitrogen at 62° represented a degree of supersaturation of more than 90. In justification of the words "plausibly uniform," an example was taken from Cain and Nicoll's paper (*Trans.*, 1902, **81**, 1416), from which it was shown that over a range of 15 per cent. of the reaction there was a continuous variation of the velocity constant amounting to 12·2 per cent. of its mean value, and the other experiment at the same temperature did not show a much greater constancy. He had, however, no intention of disputing that Cain and Nicoll had been able, owing to the very slight solubility of nitrogen, to show that the decomposition of diazobenzene chloride was possibly, even probably, a unimolecular action, but contended that the temporary state of supersaturation had seriously affected the values of their constants; in the case of actions which evolved more soluble gases, even the order of the reaction became untrustworthy. The crucial test of the development of this state was experiment, such as the simple one described above.

*25. "The triazo-group. Part VII. Interaction of benzhydroximic chloride and sodium azide." By Martin Onslow Forster.

5 : 1-*Phenylhydroxytetrazole*,  $C_6H_5\cdot C{<}\begin{array}{l}N\text{——}N\\ N(OH)\cdot N\end{array}$, is produced, instead of the expected benzhydroximic azoimide, when sodium azide and benzhydroximic chloride interact; it melts and decomposes at 124°, undergoing spontaneous decomposition in the course of a few days, and is resolved by alkalis into benzonitrile, nitrogen, and nitrous oxide. The *benzoyl*, p-*toluenesulphonic*, and *β-naphthalenesulphonic* derivatives are stable, however, decomposing at 127°, 91—92°, and 101° respectively.

*26. "The triazo-group. Part VIII. Azoimides of the monobasic aliphatic acids." By Martin Onslow Forster and Robert Müller.

A description was given of *a*-triazobutyric, *a*-triazo*iso*butyric, and *a*-triazo*iso*valeric acids, their amides and ethyl esters, with further information concerning triazoacetic and *a*-triazopropionic acids, these compounds having been studied with the object of determining the influence of environment on the stability of the triazo-group in the series.

*27. "Nitro-derivatives of ortho-xylene."

By Arthur William Crossley and Nora Renouf.

In continuance of the work, briefly described in a preliminary note (*Proc.*, 1908, **24**, 58), the action of nitrating agents on *o*-xylene has now been thoroughly investigated, with the result that all the theoretically possible mono-, di-, and tri-nitro-*o*-xylenes have been prepared. The methods adopted in establishing the constitutions of the various nitro-*o*-xylenes were discussed.

*28. "The divergence of the atomic weights of the lighter elements from whole numbers." By Alfred Charles Glyn Egerton.

The atomic weights of the first fifteen elements have been calculated according to a simple formula, in which a constant is multiplied by a constantly increasing whole number in order to obtain the divergence from whole numbers of the atomic weights. The atomic weights of the next thirteen elements have been calculated according to a slightly modified formula. The agreement is, in nearly all cases, to the second place of decimals. The relation suggests a modification of Prout's hypothesis.

DISCUSSION.

The PRESIDENT said that he considered this as an epoch-making paper. The plan brought forward differed from all previous attempts to introduce regularity into the irregular series of numbers in the periodic table, inasmuch as it was based on a definite physical conception: the addition or subtraction of groups of electrons from the atoms; or, what came to much the same thing, definite amounts of electro-magnetic attraction which might conceivably alter mass.

*29. "The constituents of the bark of Prunus serotina. Isolation of *l*-mandelonitrile glucoside." By Frederick Belding Power and Charles Watson Moore.

The material employed, consisting of the air-dried bark of *Prunus serotina*, Ehrhart, yielded on maceration with water an amount of hydrogen cyanide corresponding with about 0·075 per cent. of its weight. It has been shown to contain *l*-mandelonitrile glucoside, $C_{14}H_{17}O_6N$ (m. p. 145—147°; $[\alpha]_D - 29{\cdot}6°$), which has also been obtained in the form of its tetra-acetyl derivative (m. p. 136—137°; $[\alpha]_D - 24{\cdot}0°$), and an enzyme which hydrolyses β-glucosides. An alcoholic extract of the bark, on distillation with steam, yielded small amounts of benzoic acid and an essential oil, but no hydrogen cyanide. The non-volatile constituents of the bark consisted of a green resin, insoluble in either hot or cold water; a brown resin, soluble in the hot aqueous liquid, but deposited on cooling; and material which remained dissolved in the cold aqueous liquid. The green resin, amounting to about one per cent. of the weight of the bark, yielded a phytosterol, $C_{27}H_{46}O$ (m. p. 135—136°; $[\alpha]_D - 34{\cdot}0°$), palmitic, stearic, oleic, linolic, and *iso*linolenic acids, a little ipuranol, $C_{23}H_{38}O_2(OH)_2$, and, after acid hydrolysis, oleic acid, dextrose, and β-methylæsculetin, $C_{10}H_8O_4$. The brown resin, amounting to about one per cent. of the weight of the bark, yielded, after acid hydrolysis, traces of a phytosterol, small amounts of oleic acid, β-methylæsculetin, and dextrose, together with insoluble, red, resinous material. The portion of the alcoholic extract which was soluble in cold water contained the *l*-mandelonitrile glucoside, together with a quantity of sugar and tannin. It yielded, furthermore, benzoic, trimethylgallic, and *p*-cumaric acids, traces of a substance melting at 240—241°, and, after heating with dilute sulphuric acid, *l*-mandelic acid and β-methylæsculetin were obtained.

30. "Benzyl and ethyl derivatives of silicon tetrachloride." By Geoffrey Martin and Frederic Stanley Kipping.

The authors have made a study of certain benzyl- and ethyl-silicon compounds with the object of comparing their chemical behaviour with that of corresponding carbon compounds.

Tribenzylsilicon chloride and benzylsilicon trichloride, prepared by an improved method of applying the Grignard reagent, were decomposed by water, *tribenzylsilicol*, $Si(CH_2{\cdot}C_6H_5)_3{\cdot}OH$, and *benzylmetasilicic acid*, $C_6H_5{\cdot}CH_2{\cdot}SiO{\cdot}OH$, respectively being obtained. The former when boiled with concentrated hydrochloric acid or with dilute aqueous potassium hydroxide is converted into *tribenzylsilicyl oxide*, $[(C_6H_5\cdot CH_2)_3Si]_2O$, a change not brought about by heating the silicol alone or with acetic anhydride; acetic chloride and benzoic chloride convert the silicol into the corresponding chloride. *Tribenzylsilicyl oxide* is a colourless solid, m. p. 205°, soluble in chloroform, but sparingly so in light petroleum or alcohol.

Benzylmetasilicic acid, a resinous substance soluble in ether, does not exhibit properties analogous to those of a carboxylic acid; although soluble in potassium hydroxide solution, it does not form stable salts with organic bases. Its *ortho*-ester, $C_6H_5\cdot CH_2\cdot Si(OEt)_3$, and the *oxide*, $[C_6H_5\cdot CH_2\cdot Si(OEt)_2]_2O$, were prepared by treating benzylsilicon trichloride with ethyl alcohol; both are oils, boiling at 170—175°/(70 mm.) and 256—260°/(75 mm.) respectively. Attempts to prepare derivatives of silicon hexachloride by heating tribenzylsilicyl chloride, benzylsilicyl trichloride, and benzylethylpropylsilicyl chloride respectively with sodium or potassium were unsuccessful.

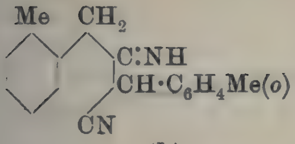
Diethylsilicon dichloride was prepared from silicon tetrachloride by the Grignard reaction, but the yield was very poor; under certain conditions a considerable proportion of the tetrachloride gives non-volatile products, from which, after treatment with water, a yellow powder may be obtained; this substance is soluble in alkali hydroxides with evolution of hydrogen, but insoluble in all other ordinary solvents, and seems to have the composition $C_2H_8O_8Si_2$.

Diethylsilicon dichloride is decomposed by water, giving a polymerised oily *silicone*, $(SiEt_2O)_n$; the hydrol, $SiEt_2(OH)_2$, apparently is not formed.

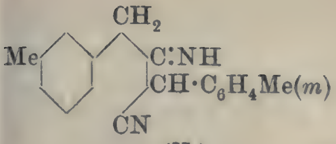
31. "The formation and reactions of imino-compounds. Part VIII. The formation of methyl derivatives of 2-phenyl-1:3-naphthylenediamine from the three tolylacetonitriles." By Stanley Robert Best and Jocelyn Field Thorpe.

Previous experiments have indicated that the transformation of a benzenoid imino-nitrile into a derivative of 1:3-naphthylenediamine by the action of cold concentrated sulphuric acid is hindered if a methyl group is in the meta-position with respect to the carbon atom at which ring formation must take place. Experiments have now been made which furnish further instances of this hindering action.

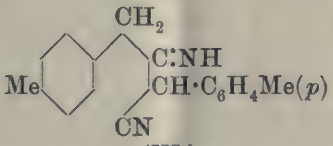
The three tolylacetonitriles readily undergo intramolecular condensation, forming *β-imino-α-cyano-αγ-di-*o*-tolylpropane* (I), *β-imino-α-cyano-αγ-di-*m*-tolylpropane* (II), and *β-imino-α-cyano-αγ-di-*p*-tolylpropane* (III):



(I.)

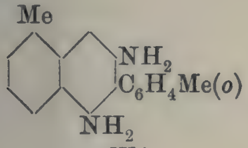


(II.)

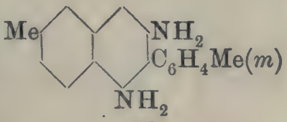


(III.)

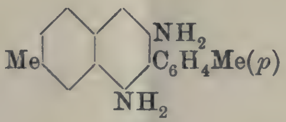
and when these compounds are treated with cold concentrated sulphuric acid they are converted into the sulphates of 6-o-*tolyl*-1-*methyl*-5 : 7-*naphthylenediamine* (IV), 6-m-*tolyl*-2-*methyl*-5 : 7-*naphthylenediamine* (V), and 7-p-*tolyl*-2-*methyl*-6 : 8-*naphthylenediamine* (VI) respectively:



(IV.)



(V.)



(VI.)

The yields of the naphthalene derivatives from the three iminonitriles are in accordance with previous observations. Thus the meta-derivative (II), from which ring formation is shown by the oxidation of the naphthalene derivative to 4-methylphthalic acid to take place in the para-position with respect to the methyl group, gives 80 per cent. of the theoretical quantity of 6-*m*-tolyl-2-methyl-5 : 7-naphthylenediamine (V), whereas from the ortho- and para-derivatives (I and III), from which ring formation has to take place in the meta-position with respect to the methyl group, scarcely more than 10 per cent. of the naphthalene derivatives (IV and VI) are obtained under the same experimental conditions. The preparation and properties of the pyrimidine derivatives derived from the three tolylacetonitriles were described.

32. "The effect of contiguous unsaturated groups on optical activity. Part I." By Thomas Percy Hilditch.

The chemical and physical behaviour of organic substances containing adjacent unsaturated groups has frequently been observed to be irregular, and, as is well known, the optical properties of refractive index and magnetic rotatory power exhibit anomalies in such cases. The present work is the first part of an investigation designed to find out if optical activity is subject to the same influences. From the collected observations of different workers, in the cases of terpene derivatives, optically active aromatic substances and optically active esters possessing conjugated unsaturated systems, the author showed that in many, but not in all, instances a pronounced increase in molecular rotatory power takes place. Further, from observations on the camphorates and camphor-β-sulphonates of a number of phenolic or amino-derivatives of substances containing a benzenoid residue adjacent to an ethylenic or carbonyl group, it is found that:

(1) Conjugation is accompanied by abnormal optical activity.

(2) The effect reaches a maximum when the conjugated system is nearest to the asymmetric carbon atoms.

(3) The effect is lessened as the proximity of the unsaturated groups to one another is lessened.

(4) The effect is decreased, and sometimes completely destroyed, if a saturated group is interposed between the conjugated and asymmetric systems.

33. "The miscibility of solids." By Ernest Vanstone.

While working on solid solutions with camphor, the author was led to develop the present theory. The explanation of the miscibility of solids is suggested by the Pope and Barlow theory, and may be stated as follows: Two substances will show the greatest degree of miscibility, whose assemblages of spheres of atomic influence possess similar marshalling, and are capable of being partitioned into units possessing almost equal volumes, the volumes being the molecular domains.

This explanation applies to the miscibility of the elements and of compounds, both organic and inorganic.

The degree of miscibility of two elements depends on the closeness of agreement between the atomic volumes, and also on their valency values, and this accounts for the great tendency of the elements to form mixed crystals.

Where a difference in valency volumes exists, a slight expansion of the spheres composing the substance of lower valency volume causes the volume of the molecular unit to approximate closely to that of the substance of higher valency volume.

The freezing-point curves for camphor and borneol, benzoin and benzil, and menthol and menthone have been obtained. The first pair of compounds forms solid solutions in all proportions, borneol raising the freezing point of camphor continuously. Benzoin and benzil show a curious behaviour, as the curve has two eutectic points with an intermediate horizontal portion. The curve for menthol and menthone appears to be continuous with a minimum point.

34. "Esterification constants of substituted acrylic acids. Part III." By John Joseph Sudborough and James Mylam Gittins.

The constants at 15°, using methyl alcohol with hydrogen chloride as catalyst, have been determined for the following acids: *cyclo*-Hexanecarboxylic, phenylacetic, α- and β-phenylpropionic, γ-phenyl-*n*-butyric, δ-phenyl-*n*-valeric, furfurylpropionic, phenylbenzylacetic, undecylenic, oleic, elaidic, erucic, brassidic, phenyl-βγ-crotonic, allylacetic, sorbic, cinnamylideneacetic, hydrosorbic, cinnamenylpropionic, β-phenylethylidenepropionic, phenylpropylideneacetic, αβ-oleic, *allo*cinnamic, and tetrolic. The results confirm the conclusions previously drawn (*Trans.*, 1905, **87**, 1840; 1907, **91**, 1033).

The constants for αβ-unsaturated acids are remarkably low when compared with those for the corresponding saturated acids. βγ-Unsaturated acids have constants somewhat larger than those for their saturated analogues, and double bonds which are still further removed from the carboxylic group have very little effect, so that there is practically no difference between the constants for the unsaturated and the corresponding saturated acid.

The effect of the reduction of benzoic to *cyclo*hexanecarboxylic acid is remarkable, the constant being raised from 0·25 to 19·3.

A triple linking in the αβ-position has much the same effect as a double bond in the same position, and conjugate ethylene linkings have a somewhat greater retarding effect than an αβ-double linking.

35. "Brazilin, hæmatoxylin, and their derivatives. Part X. The constitution of trimethylbrazilone, of α- and β-anhydrotrimethylbrazilone, and of the corresponding derivatives of hæmatoxylin." By William Henry Perkin, jun., and Robert Robinson.

The authors described in detail the properties of the derivatives mentioned in the title with the object of proving that the constitutional formulæ assigned to them in the previous parts of this research are correct.

36. "The preparation of disulphides. Part III. The nitrobenzyl disulphides. (A correction.)" By Thomas Slater Price and Douglas Frank Twiss.

In a recent communication on the nitrobenzyl disulphides (*Trans.*, 1908, **93**, 1401), the statement was made that "the three disulphides obtained in the course of this investigation have not been isolated before." This statement is erroneous so far as the ortho- and meta-disulphides are concerned, but it does not affect the subject-matter of the paper cited, since a new method of preparation of these disulphides is there given.

Jahoda (*Monatsh.*, 1890, **10**, 874) claimed to have prepared di-*o*-nitrobenzyl disulphide (this nomenclature is to be preferred to *o*-nitrobenzyl disulphide), but Gabriel and Stelzner (*Ber.*, 1896, **29**, 161) showed that Jahoda's product was really the mercaptan. They prepared the *o*-disulphide and found it to consist of yellow crystals which melted at 112—113°, these properties agreeing with those found by Gabriel and Posner (*Ber.*, 1895, **28**, 1025) and Cassirer (*Ber.*, 1892, **25**, 3029). In 1901, Blanksma (*Rec. trav. chim.*, 1901, **20**, 137) also prepared di-*o*-nitrobenzyl disulphide (this compound is not mentioned in *Abstr.*, 1901, **80**, i, 461) and found that it melted at 110°. This melting point agrees with that observed by the authors (109·5°), but they also find that on repeated crystallisation from alcohol the crystals become almost colourless, possessing only a slight yellow tinge.

Di-*m*-nitrobenzyl disulphide has been prepared by Lutter (*Ber.*, 1897, **30**, 1069) by oxidation of the corresponding mercaptan with iodine, and is described as consisting of yellowish-white crystals melting at 103—104°. The melting point agrees with that observed by the authors, but when pure the substance is almost colourless; individual crystals appear colourless, but in bulk they possess a faint yellow tinge.

Strakosch (*Ber.*, 1872, **5**, 692) claims to have obtained di-*p*-nitrobenzyl disulphide. The melting point given, 89°, is quite different from that observed by the authors (126·5°), and does not correspond with the melting points of the *o*- and *m*-compounds. The analytical results are also not satisfactory, 19·72 per cent. of sulphur being found instead of 19·05 per cent. Evidently the compound prepared by Strakosch was not the disulphide, and the authors are engaged in repeating his experiments. The pure substance possesses a colour similar to that of the *m*-disulphide.

37. "Derivatives of naphthacenequinone. Part III." By Dorothy Harrop, Roland Victor Norris, and Charles Weizmann

In continuation of previous work (*Trans.*, 1907, **91**, 1588), the authors have prepared a further series of naphthacenequinone derivatives.

38. "The nature of ammoniacal copper solutions. Part II. The solubility of cupric hydroxide in ammoniacal sulphate solutions." By Harry Medforth Dawson.

With the object of supplementing the information already obtained concerning the nature of ammoniacal solutions of copper salts (compare Dawson, *Trans.*, 1906, **89**, 1666; 1900, **77**, 1239), the author has measured the solubility of cupric hydroxide in ammoniacal solutions of ammonium and sodium sulphates, and of barium and sodium hydroxides.

Cupric hydroxide does not dissolve directly in pure ammonium sulphate solutions, and this is an indication that cupridiammonia compounds either do not exist or are not readily formed. In presence of ammonia the hydroxide dissolves readily, and ammonia therefore appears to be the primary cause of the solution process, cupritetraammonia hydroxide being thereby formed. This then reacts with the ammonium sulphate in the solution, the action consisting in the partial displacement of the ammonia from the sulphate by the stronger cupriammonia base, a condition of equilibrium being set up corresponding with the scheme:

$$Cu{\cdot}4NH_3(OH)_2 + (NH_4)_2SO_4 \rightleftharpoons Cu{\cdot}4NH_3SO_4 + 2NH_4OH.$$

The solubility data are consistent with this view.

From a consideration of the quantities of ammonia which are necessary to dissolve cupric hydroxide in such quantity that the resulting solution contains copper and sulphate in equivalent proportions, the conclusion is drawn that optically clear solutions, prepared by adding ammonia (not in large excess) to copper sulphate solutions, are supersaturated with respect to cupric hydroxide. When such solutions are shaken with cupric hydroxide, a diminution in the copper concentration is actually observed. The deposited copper is supposed to be present in the original solution in the form of colloidal hydroxide.

The new observations are in agreement with the author's previous determinations of the chemical dissociation in ammoniacal solutions of copper salts on the basis of distribution measurements.

39. "The action of β-rays on photosensitive solutions."

By Otto Flaschner.

The analogy between the action of light and that of β-rays on certain chemical reactions was pointed out and instanced in the case of two photosensitive solutions. The potential of an AgBr/KBr electrode rises under the influence of β-rays, and falls when the latter disappear. The higher the initial potential the more sensitive is the electrode towards light and β-rays.

The Eder's actinometric solution was the second type to be examined, and this is also influenced by β-rays.

40. "The rusting of iron." By Gerald Tattersall Moody.

In the experiments described by Tilden (*Trans.*, 1908, **93**, 1356), that author has lost sight of the well-known fact that commercial iron and steel invariably contain foreign substances, notably sulphur compounds, which on exposure to air and water at once furnish free acids. The rusting observed in Tilden's experiments, in which carbonic acid was excluded, was a result primarily of interaction between acids, formed by oxidation of sulphur compounds and other foreign constituents capable of furnishing acids on reaction with water and oxygen, and iron, the resulting ferrous salt being subsequently oxidised with production of rust.

Tilden's experiments conclusively show that commercial iron after treatment with chromic acid no longer rusts in presence of water and oxygen, but the inactivity is wrongly attributed to the chromic acid rendering the iron "passive." The true explanation of the inhibitive effect of chromic acid is that it removes from the surface of the iron those constituents which would otherwise subsequently yield acids on exposure to water and oxygen. That Tilden's view that the iron is rendered passive is incorrect is conclusively shown by the readiness with which the iron rusts as soon as normal air containing carbonic acid or any other acid is admitted.

Tilden further states that after immersion for years of iron in dilute chromic acid, he has observed "no sign of rust or of dissolution of the iron either by change of colour or the formation of precipitate on adding excess of ammonia." In this connexion it must be pointed out that ferric hydroxide is readily dissolved by chromic acid, so that visible change could not be expected. Moreover, dilute solutions of iron in chromic acid do not afford a visible precipitate or a change of colour on addition of excess of ammonia. If, however, the solution is filtered after addition of ammonia, ferric hydroxide in appreciable quantity remains on the filter-paper, and the dissolution of the iron is thereby made evident.

41. "The iodobenzenemonosulphonic acids. Part I." By Mary Boyle.

An account was given of the preparation and properties of 1 : 4 : 6-, 1 : 3 : 4-, 1 : 3 : 5-, and 1 : 2 : 4-*di-iodobenzenesulphonic acids*; also of 1 : 2 : 3 : 5-, 1 : 2 : 4 : 5-, and 1 : 2 : 4 : 6-*tri-iodobenzenesulphonic acids*. The acids were mostly prepared from the appropriate aminosulphonic acids by introducing iodine by means of iodine chloride and subsequently displacing the amino-group by iodine by the diazo-reaction.

It is noteworthy that all the iodo-diazo-sulphonates are coloured compounds, varying from very pale yellow in the case of the 1 : 4-acid to bright yellow in the case of the tri-iodo-acids.

The acids are all readily soluble in water, and several crystallise well, especially in presence of mineral acid. They furnish well-defined salts, which are only sparingly soluble in water. The sulphonyl chlorides crystallise well.

42. "Contributions to the chemistry of the terpenes. Part IV. The oxidation of pinene with mercuric acetate." By George Gerald Henderson and James Watson Agnew.

By the action of aqueous mercuric acetate at the ordinary temperature, pinene is converted into sobrerol, $C_{10}H_{16}(OH)_2$, a compound formerly prepared by oxidising pinene with moist oxygen in sunlight, and sobrerol is oxidised to a hydroxyketone, $C_{10}H_{15}(OH)O$, when heated with the same reagent. The hydroxyketone is reduced to sobrerol when dissolved in moist ether and treated with sodium, and it yields carvacrol on reduction with aqueous hydriodic acid in the cold. When heated for a short time with anhydrous oxalic acid, it yields carvone together with some carvacrol, and when it is oxidised with an acidified solution of potassium permanganate, terpenylic acid is obtained. Hence it is concluded that the hydroxyketone is 8-hydroxycarvotanacetone.

Sobrerol can also be prepared by the action of mercuric oxide on a cold solution of pinene in acetic acid, whilst if the solution is heated, the oxidation product is the hydroxyketone,

43. **"Formation of heterocyclic compounds. Part I. 1-Phenylpyrrolidine-2 : 5-dicarboxylic acid from adipic acid." By Henry Rondel Le Sueur.**

The *methyl* or *ethyl* ester of 1-phenylpyrrolidine-2 : 5-dicarboxylic acid is readily obtained by the action of monoethylaniline on the corresponding methyl or ethyl ester of *aa′*-dibromoadipic acid.

1-*Phenylpyrrolidine*-2 : 5-*dicarboxylic acid* is crystalline, and decomposes at 252°; it is readily obtained by hydrolysis of its ethyl ester.

44. **"The influence of solvents on the rotation of optically active compounds. Part XIV. Ethyl tartrate in benzaldehyde and in quinoline." By Thomas Stewart Patterson and David Paterson McDonald.**

The influence of benzaldehyde and of quinoline as solvents on the rotation of ethyl tartrate was described.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Académie des Sciences, Paris. Comptes rendus hebdomadaires des séances de l'Academie. Vol. lxxiv—lxxxv. 12 vols. Paris 1872–77. (*Circulating.*) From Dr. Horace T. Brown.

Archibald, *R. D.*, and **Rankin,** *R.* Electrical laboratory course. pp. vi + 95. ill. London 1908. (*Recd.* 20/11/08.)
From the Publishers: Messrs. Blackie & Son.

Browning, *Philip E.* Introduction to the rarer elements. 2nd edition. pp. x + 207. New York 1908. (*Recd.* 5/1/09.)
From the Publishers: Messrs. John Wiley & Sons.

Dannerth, *Frederic.* The methods of textile chemistry. pp. viii + 164. New York 1908. (*Recd.* 27/11/08.)
From the Publishers: Messrs. John Wiley & Sons.

Donnan, *Frederick George.* Kupfer und seine Verbindungen. [Abegg's Handbuch der Anorganischen Chemie. II. i.] pp. 469 to 654. (*Recd.* 12/1/09.) From the Author.

Dunstan, *Albert Ernest.* An organic chemistry for schools and technical institutes. pp. viii + 160. ill. London 1908. (*Recd.* 10/11/08.) From the Publishers: Messrs. Methuen & Co.

Johnson, *Grove.* The student's manual of yeast culture. pp. xv + 180. ill. London 1908. (*Recd.* 10/11/08.) From the Author.

Kissling, *Richard.* Das Erdöl, seine Verarbeitung und Verwendung. Eine gedrängte Schilderung des Gesamtgebietes der Erdöl-Industrie. pp. x + 154. ill. Halle a. S. 1908. (*Recd.* 4/1/09.) From Dr. J. Lewkowitsch.

Lewkowitsch, *Julius.* Technologie et analyse chimiques des huiles, graisses et cires. Traduit . . . par *Émile* **Bontoux**. Tome II. pp. xiii + 563 to 1423. ill. Paris 1909. (*Recd.* 14/1/09.) From the Author.

Lunge, *George.* Technical chemists' handbook. Tables and methods of analysis for manufacturers of inorganic chemical products. pp. xv + 260. ill. London 1908. (*Recd.* 5/12/08.) From the Author.

Mathewson, *C. H.* First principles of chemical theory. pp. vii + 123. New York 1908. (*Recd.* 5/1/09.) From the Publishers: Messrs. John Wiley & Sons.

Morgan, *J. Livingston R.* The elements of physical chemistry. 4th edition. pp. xiv + 539. New York 1908. (*Recd.* 27/11/08.) From the Publishers: Messrs. John Wiley & Sons.

Pharmaceutical Society of Great Britain. Catalogue of the Library. 9th edition. Compiled by *John William* **Knapman**. pp. 715. London 1905. (*Reference.*) From the Society.

Plimmer, *R. H. Aders.* The chemical constitution of the proteins. In 2 parts. pp. xii + 100, xi + 66. London 1908. (*Recd.* 28/11/08.) From the Publishers: Messrs. Longmans, Green & Co.

Richards, *Ellen H.* Laboratory notes on industrial water analysis. pp. iii + 49. New York 1908. (*Recd.* 5/1/09.) From the Publishers: Messrs. John Wiley & Sons.

Roscoe, *Sir Henry Enfield*, and **Schorlemmer**, *Carl.* A treatise on chemistry. Vol. II. The metals. New edition, completely revised by *Sir H. E.* **Roscoe** and *A.* **Harden**. pp. xvi + 1436. ill. London 1907. (*Recd.* 19/12/08.) From Sir H. E. Roscoe.

Royal Society. Some account of the "letters and papers" of the period 1741–1806 in the archives. With an index of authors. Compiled by *A. H.* **Church**. pp. 73. Oxford. Printed for the author. 1908. (*Recd.* 9/12/08.) From Professor A. H. Church.

Société chimique de France. Cinquantenaire. pp. iv + 146. (42 plates.) Paris 1908. (*Reference.*) From the Society.

Turner, *Thomas.* The metallurgy of iron. pp. xvi + 463. ill. London 1908. (*Recd.* 3/12/08.) From Professor W. A. Tilden.

Woburn Experimental Fruit Farm. Ninth report. By the **Duke of Bedford** and *Spencer U.* **Pickering**. pp. 95 + xlvii. ill. London 1908. (*Recd.* 19/12/08.) From the Authors.

II. *By Purchase.*

Bowman, *Frederic Hungerford.* The structure of the cotton fibre in its relation to technical applications. pp. xx + 470. ill. London 1908. (*Recd.* 19/12/08.)

—— The structure of the wool fibre and its relation to the use of wool for technical purposes. pp. xx + 475. London 1908. (*Recd.* 19/12/08.)

Lundén, *Harald.* Affinitätsmessungen an schwachen Säuren und Basen. (Sammlung, Vol. XIV.) Stuttgart 1908.

Squire, *Peter Wyatt.* Companion to the latest edition of the British Pharmacopœia, comparing the strength of its various preparations with those of the United States, and other foreign pharmacopœias, to which are added not official preparations, and practical hints on prescribing. 18th edition. pp. xlii + 1417. London 1908. (*Recd.* 17/12/08.)

Watt, *Sir George.* The commercial products of India. Being an abridgement of "The dictionary of economic products of India." pp. viii + 1189. London 1908. (*Recd.* 17/12/08.)

Wiley, *Harvey W.* Principles and practice of agricultural analysis. Vol. II. Fertilizers and insecticides. pp. xi + 680. ill. Easton, Pa. 1908. (*Recd.* 3/12/08.)

Zeitschrift für anorganische Chemie. Generalregister der Bände 1—50 (1892–1906). pp. xxiv + 652. Hamburg 1908. (*Reference.*)

III. *Pamphlets.*

Ghose, *Anu.* The mode of occurrence of manganite in the manganese ore deposits of the Sandur State, Bellary, Madras, India. (From the *Trans. Inst. Min. Eng.*, 1908.)

India. *Imperial Department of Agriculture.* Report for the years 1905–06 and 1906–07. Calcutta 1908.

Jackson, *A. Hendrick.* The lead accumulator electrolyte. [1908.]

Lett, *Stephen J.* More about Zambesia minerals. (From the *Mining Journal*, 1908.)

Meininger, *Ernst.* Beitrag zur Kenntnis einiger Gummiarten. Mülhausen, 1908.

Mielck, *Wilhelm.* Pharmakognostisch-chemische Untersuchung des javanischen Lackharzes "Gala-Gala." Strassburg 1908.

Rathje, *Arnold.* Neuere Untersuchungen der Fette von Lycopodium, Secale cornutum, Semen Arecae und Semen Aleuritis cordatae sowie der brasilianischen Pflanzenmilch Amapa. Kiel 1908.

Siebeck, *Adolf.* Ueber einige organische Eisensalze. Wattenscheid 1908.

Simmer, *August.* Ueber das Verhalten der Alkaloidsalze und anderer organischer Substanzen zu den Lösungsmitteln der Perforationsmethode, insbesondere Chloroform, sowie über Reduktionswirkungen der Alkaloide. Strassburg 1906.

Sommerfeldt, *Ernst.* Thermochemische und thermodynamische Methoden, angewandt auf den Vorgang der Bildung von Mischkrystallen. Stuttgart 1900.

—— Petrographisch-chemische Untersuchungen an den Basalten des südlichen Bakony. Budapest 1908.

Transvaal. *Government Laboratories.* Annual Report for the year 1906–7. Pretoria 1908.

Weiss, *Hermann.* Pharmakognostische und phytochemische Untersuchung der Rinde und der Früchte von Aegiceras majus G., mit besonderer Berucksichtigung des Saponins. Strassburg 1906.

Wentrup, *Franz.* Beiträge zur Kenntnis der Saponine. Strassburg 1908.

West Indies. *Imperial Department of Agriculture.* Sugar-cane experiments in the Leeward Islands. Report on experiments conducted . . . in the season 1906–7. 2 parts. Barbados 1908.

ANNIVERSARY DINNER.

It has been arranged that the Fellows of the Society and their friends shall dine together at the Whitehall Rooms, Hotel Metropole, at 6.30 for 7 o'clock, on Thursday, March 25th, 1909 (the day fixed for the Annual General Meeting).

The price of the tickets will be One Guinea each, including wine.

All applications for tickets must be received not later than Thursday, March 18th next.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, made payable to "Mr. S. E. Carr" and addressed to the Assistant Secretary, Chemical Society, Burlington House, W.

At the next Ordinary Meeting on **Thursday**, February **18th**, 1909, there will be a ballot for the election of Fellows and the following papers will be communicated :

"A study of some asymmetric compounds." By F. S. Kipping.

"The decomposition and sublimation of ammonium nitrite under the influence of heat." By P. C. Rây.

"The estimation of hydroxyl derivatives in mixtures of organic compounds." By H. Hibbert.

"A simple method for determining the chemical affinity of organic substances." By H. Hibbert.

"The isolation of the aromatic sulphinic acids." By J. Thomas.

"Analytical investigation of zirconium metal." By E. Wedekind and S. Judd Lewis.

"Chlorine generated by potassium permanganate, its preparation and purity." By E. Wedekind and S. Judd Lewis.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, February 18th, 1909.

Adlam, George Henry Joseph,
86, Southmoor Road, Oxford.

Science Master, Boys' High School, Oxford. B.A. (Oxford). First-class in School of Natural Science, 1905 (Chemistry). Engaged in research in collaboration with Dr. H. B. Baker.

William Odling. W. W. Fisher.
H. B. Baker. C. Stanley Gibson.
J. E. Marsh.

Brunskill, Hubert,
7, Friarage Gardens, Hartlepool, Durham.

Teacher (Secondary). Inter.B.Sc. (London); Honours, Chemistry. Three years Science Teacher. I wish to join in order that I may keep up to date in chemical science, which I find rather difficult here; and also that at some future period I may contribute work on organic or physical chemistry.

Fred. Phillips. W. T. L. Leeming.
J. H. Howgate. W. H. Hurtley.
J. W. Patterson. *Sidney Harvey.*

Clayton, Arthur,
35, Sisters Avenue, Clapham Common, S.W.

Teacher of Chemistry. Author of "The Residual Affinity of the Coumarins," *J.C.S.*, 1908, and "The Coumarin Condensation," 1908. B.Sc., Hon. (London).

William A. Tilden. G. T. Morgan
James C. Philip. M. O. Forster.
Chapman Jones.

Cocksedge, Herbert Edwin,

5, Romola Road, Herne Hill, S.E.

Research Student. B.A. Final Honours Chemistry, Oxford, 1907 (1st); qualified for B.Sc. by research (Oxon.), 1908.

H. Brereton Baker. N. V. Sidgwick.
Andrea Angel. F. D. Chattaway.
J. E. Marsh.

Coles, Alfred Bertram,

42, Broadwater Road, Tottenham, N.

Science Master, Tottenham County School; Lecturer, Tottenham Polytechnic. M.A. (Oxon). Second Class Honours in Chemistry in Final School of Natural Science, Oxford, 1904. Science Master, Carmarthen Grammar School, 1904–1907. Sept. 1907: Senior Science Master, Tottenham County School, and Lecturer in Chemistry at Tottenham Polytechnic.

Andrea Angel. J. E. Marsh.
H. B. Baker. W. W. Fisher.
R. de J. Fleming Struthers.

Coope, John Charles Jesser,

Bulawayo, Rhodesia, South Africa.

Farmer. Diploma of the British Dairy Farmers' Association for proficiency in dairying and dairy farming; National Diploma (of England) for proficiency in science and practice of dairying; is an ex-student of British Dairy Institute and University College, Reading. Proposes to carry on investigations in dairying and agriculture in South Africa.

John W. Taylor. J. Augustus Voelcker.
J. F. Blackshaw. *Fredk. J. Lloyd.*
C. W. Walker Tisdale. *J. K. H. Inglis.*
E. K. Hanson.

Dunn, Frederick Percy,

Haresfield, Chorley Wood, Herts.

Research Student at the Royal College of Science. Educated at the Mercers' School; completed the Associateship Course in Chemistry at the Royal College of Science; Bachelor of Science (Lond.), Honours in Chemistry.

William A. Tilden. James C. Philip.
M. O. Forster. G. T. Morgan.
Taylor Cook.

Ferraboschi, Frederic,

Clare College, Cambridge.

Assistant Demonstrator at Cambridge University; engaged in research. Late scholar of Clare College, Cambridge. Paper on "A Double Sulphate of Guanidine and Aluminium" (*Proc. Camb. Phil. Soc.*, 1908, p. 471).

H. J. H. Fenton.
H. O. Jones.
W. J. Sell.
F. W. Dootson.
J. E. Purvis.

Fox, John Thomas,

Glen Burn, Stollard Street, Clay Cross, near Chesterfield.

A student and intending Science Master. Intermediate B.Sc., London, obtained two years ago last July, that is 1906. I have just finished a term of four years at the University College, Nottingham, the last two years of which have been occupied in preparation for the Honours B.Sc. in Chemistry of the London University, and I desire to follow the latest researches to continue the preparation.

Fredk. Cowling.
F. Stanley Kipping.
Harry J. Unwin.
R. M. Caven.
A. H. Salway.

Francis, Arthur Gordon,

50, Whitbread Road, Brockley, S.E.

Analyst in the Government Laboratory. Bachelor of Science (Hons.), London University. Fellow of the Institute of Chemistry. Six years' experience in the Government Laboratory under Dr. Thorpe, F.R.S., Mr. E. Grant Hooper, F.I.C., and Mr. W. T. Burgess, F.I.C.

T. E. Thorpe.
James C. Philip.
E. Grant Hooper.
G. T. Morgan.
William A. Tilden.
William T. Burgess.
M. O. Forster.
Charles A. Keane.

Furnell, John Thomas,

Acacia House, 32, Grosvenor Park Road, Walthamstow, Essex.

Paint and Colour-Mill Room Manager; practical experience extending twenty-five years. Registered as Technical Teacher, City and Guilds of London Institute. Ten years Teacher at the Polytechnic, Regent Street, W., in Painters' Colours, Oils, and Varnishes. Author of "Students' Handbook"; one of the Founders of the Paint and Varnish Society, London.

J. Cruickshank Smith.
C. Sordes Ellis
Frank E. Weston.
H. R. Ellis.
William A. Colebourn.
W. H. Collier.

Gortner, Ross Aiken,

Lincoln, Nebraska, U.S.A. Present Address: 430, West 118th Street, New York City, U.S.A.

Fellow in Chemistry, Columbia University, New York City. B.Sc., Nebraska Wesleyan University, 1907. M.A., University of Toronto, 1908. Assistant in Chemistry, Nebraska Wesleyan University, 1904–6. Research Assistant in Chemistry, University of Nebraska, 1906–7. Assistant in Chemistry, University of Toronto, 1907–8. Fellow in Chemistry, Columbia University, New York City, 1908–9. Author of "Some Effects of Sunlight upon Colourless Glass," *Am. Chem. Jour.*, 157 (1908). Joint author of "Ueber Zwei Aromatische Nitrosoverbindungen," *Ber.*, **38**, 1899 (1905). "The Condensation of the Three Nitranilines with *p*-Nitroso-benzaldehyde," *Am. Chem. Jour.*, **36**, 510 (1906). "The Molecular Weights of the Yellow Nitroso-compounds," *Am. Chem. Jour.*, **32**, 400 (1904). "Soils of the Great Plains Region—The Third Steppe," *Am. Chem. Jour.*, **37**, 1 (1907). "The Detection of Bleached Flours," *Jour. Am. Chem. Soc.*, **29**, 1503 (1907). "Studies on Some Soils from Saskatchewan," *Am. Chem. Jour.*, **39**, 163 (1908). "Some Esters of Arsenious Acid," *Trans. Chem. Soc.*, **93**, 1364 (July, 1908).

W. R. Lang. W. Lash Miller.
W. H. Ellis. *William Ramsay.*
W. B. Tuck.

Green, John Wilberforce,

22, Alwyne Road, Wimbledon.

Science Teacher. Student under R. Meldola. Assistant to C. E. Cassal, F.I.C. Works Chemist at National Explosives Co. and at Kynoch's, Ltd. Science Master at King's College School, Wimbledon Common, for last six years (appointed by Council of King's College, London).

W. J. Atkinson Butterfield. A. T. Cocking.
Bertram Blount. *Harold G. Colman.*
J. H. Coste.

Gwyer, Alfred George Cooper,

Keate House, Durdham Down, Bristol.

Chemist. B.Sc. (London); Ph.D. (Göttingen). 1905–7, 1851 Exhibition Science Research Scholar, Univ. Coll., Bristol. "On the Comparison of the Platinum Scale of Temperature with the Normal Scale at Temperatures between 444° and – 190° C.," with Morris W. Travers, *Proc. Roy. Soc.*, **74** (1905), p. 528. "Über Al-Bi und Al-Sn

Legierungen," *Zs.f. anorg. Chem.*, **49** (1906), 311. "Über die Legierungen des Aluminiums mit Cu, Fe, Ni, Co, Pb, und Cd," *Zs.f. anorg. Chem.*, **57**, (1908), 113.

William Ramsay. J. C. Cain.
Edward C. Cyril Baly. H. E. Watson.
R. W. Gray.

Harland, Robert Main,

296, Willesden Lane, Willesden Green, N.W.

Analytical Chemist and Assayer. In practice as Analytical Chemist and Assayer, under style of Harland & Brown, of 37, Lombard Street, E.C.

C. T. Kingzett. B. E. R. Newlands.
R. C. Woodcock. *Samuel Rideal.*
W. R. Hodgkinson.

Haworth, Walter Norman, M.Sc.,

Dacca House, Chorley, Lancs.

Schunck Research Assistant in the Chemical Laboratories of the University of Manchester. Joint author of the following papers in the *Journal* of the Chemical Society: "Synthesis of Terpins, Terpineols, and Terpenes derived from Methyl*iso*propyl*cyclo*pentanes" (with Prof. W. H. Perkin), *Trans.*, 1908, **93**, 573; also "Experiments on the Synthesis of 1-Methyl*cyclo*hexylidene-4-acetic Acid. Part II." (with V. J. Harding and Prof. W. H. Perkin), *Trans.*, 1908, **93**.

Harold B. Dixon. J. F. Thorpe.
W. H. Perkin. G. H. Bailey.
Norman Smith.

Hayward, Eric,

c/o W. R. Criper, Esq., Konnagar House, Konnagar, near
Calcutta.

Manufacturing and Analytical Chemist (of D. Waldie & Co., Calcutta). Student at Finsbury Technical College, 1904 to 1907. King's College, London, 1907 and 1908. Passed the examination for A.I.C.

John M. Thomson. Henry R. Lyell.
Herbert Jackson. Alf. Chaston Chapman.
Patrick H. Kirkaldy. F. Guy Stirling Baker.

Higson, Frank,

Ivy Bank, Castle Street, Haulgh, Bolton, Lancashire.

Analytical Chemist. Assistant to Dr. Wagstaffe, M.Sc., F.I.C., Analytical and Consulting Chemist, Manchester.

R. L. Taylor. Stanley J. Peachey.
T. M. Nightingale. *James Ashton.*
C. A. Fogg.

Hoseason, James Henry,

Alderside, Timperley, Cheshire.

Manufacturing Chemist. Partner and Works Manager, Hough, Hoseason & Co., Manchester. Pharmaceutical Chemist. Six years Lecturer in Pharmacy, Materia Medica, and Pharm. Chemistry, Owens College, Victoria University, Manchester. Published various papers and notes of Pharmaceutical interest from the year 1889 on.

W. H. Perkin. F. Stanley Kipping.
G. H. Bailey. Francis J. H. Coutts.
J. F. Thorpe. Wm. B. Cowie.
Gilbert J. Fowler. Gerald Pinchbeck.
B. Prentice.

Hough, Ralph,

14, Longford Place, Victoria Park, Manchester.

Manufacturing Chemist. Chemist and Druggist. Partner and Manager of Messrs. Hough, Hoseason & Co., Manchester.

Francis J. H. Coutts. Gerald Pinchbeck.
Wm. B. Cowie. *Gilbert J. Fowler.*
B. Prentice.

Jackson, Robert Ernest,

York Villa, Shepherds Lane, Dartford.

Chemist in Factory (Wellcome Chemical Factory). Engaged in manufacture of medicinal chemicals, and desiring to keep in touch with modern progress in chemistry.

H. A. D. Jowett. Frederic H. Lees.
William C. Reynolds. Francis H. Carr.
Frank Lee Pyman.

Jeffery, John Hugh,

10, Daysbrook Road, Streatham Hill, London, S.W.

Analytical Chemist. Student in Chemical Department, King's College, London, during the Sessions 1905–8. Now Assistant to Mr. G. Cecil Jones, F.I.C.

John M. Thomson. Patrick H. Kirkaldy.
G. Cecil Jones. Henry R. Lyell.
Herbert Jackson. Tom R. Greenough.

Jones, Henry Humphreys,
18, Colquitt Street, Liverpool.

Teacher of Chemistry and Pharmacy at the Liverpool School of Pharmacy. Pharmaceutical Chemist.

A. C. Abraham.
J. W. Clayton.
J. H. Allan.
Prosper H. Marsden.
A. W. Titherley.

Keeble, Horace,
Wereham, Stoke Ferry, Norfolk.

Technical Chemist. Had experience in Sulphate of Ammonia Works; now engaged at Sulphate of Ammonia Works (Destructive Distillation of Peat) at Wereham, Norfolk. Recently (extending over six months) conducted chemical research on peat in the laboratory of William Elborne, Esq., M.A., Public Analyst and Official Agricultural Analyst for Peterborough.

F. W. Branson.
J. H. Gough.
William Kirkby.
Robert Wright.
B. A. Burrell.
Thomas Fairley.

Leedham, Joseph,
176, Bromford Lane, West Bromwich.

Analytical Chemist. Chemist to Messrs. Willingsworth Iron Co., Incorp. (1908), Ltd., Wednesbury. Four years (articled) to Mr. J. Lones, F.I.C., Analyst to County Borough of Smethwick.

Arthur Adams.
R. Lloyd Whiteley.
F. H. Alcock.
Harry Silvester.
E. W. T. Jones.

McGillvray, John Esson,
15, Regent Street, Hartlepool.

Science Master. M.A. Degree (Edin.); 1st Class in Theor. and Practical Chemistry; Inter. B.Sc. (Lond.); 4 years Science Master, Pupil Teachers' Centre; Certificate classes, etc.

Alex. Crum Brown.
J. W. Patterson.
J. Archyll Jones.
Geo. Fredk. Phillips.
W. H. Jackson.

Martin, William George, B.Sc. (Wales),
Royal School, Armagh.

Schoolmaster (Chemistry and Physics). Three years senior Science Master, Sandymount Presbyterian College, Dublin. Associate of

Univ. College of S. Wales and Monmouthshire; B.Sc. (Wales). For 4 years Monmouthshire C.C. Technical Scholar.

W. H. Cadman. H. M. Atkinson.
A. O'Farrelly. Geo. A. Watson.
James H. Pollok.

May, Percy,

126, Cazenove Road, Stamford Hill, N.

Research Student and Demonstrator in Chemistry at University College, London. Research Student and Demonstrator; Tuffnell Scholar, etc., University College, London.

William Ramsay. R. W. Gray.
H. E. Watson. A. W. Stewart.
Samuel Smiles. N. T. M. Wilsmore.

Morley, William Norton,

325, Brownhill Road, Catford, S.E.

Chemistry Student; after Jan., 1909, Schoolmaster. 2nd Class Honours Chemistry at B.Sc., 1908. Research Student and Demonstrator in Chemistry at University College, London; just appointed an assistant master at Colfe's Grammar School, Lewisham, and wish to keep in touch with the advance of Chemistry.

William Ramsay. Edward C. Cyril Baly.
J. Norman Collie. Samuel Smiles.
E. de Barry Barnett.

Painter, Frederick Hubert, B.Sc. (Lond.),

Heatherbank, Alum Chine Road, Bournemouth.

Teacher of Chemistry and Physics. Head Science Master and Lecturer in Chemistry and Physics at the Bournemouth Schools of Science and Art from Sept., 1896, to the present time. For several years previous to 1896 was engaged in private tuition in Chemistry.

Arthur P. Luff. *G. E. Scott-Smith.*
Fredk. Hudson-Cox. *John Evans.*
John G. Howarth. *S. Ernest Melling.*
George Brownen. *Wm. H. Simmons.*

Pickard, Joseph Allen,

3, West Kensington Terrace, W.

Asst. Demonstrator in Chemistry at the Royal College of Science. Associate of the Royal College of Science, London (in Chemistry). B.Sc. London (Chemistry).

William A. Tilden. James C. Philip.
G. T. Morgan. W. Godden.
M. O. Forster.

Pope, Frank Geo.,

28, Alcester Crescent, Upper Clapton, London, N.E.

Assistant Lecturer, East London College (Chem. Dept.). Whole or part author of papers, *Transactions*, 1896 (1265); 1897 (1084); 1898 (174); 1901 (1146); 1908 (532). *Berichte*, 1896 (2824); 1897 (1624).

J. T. Hewitt.
Edward C. Cyril Baly.
Clarence Smith.
John Wade.
M. O Forster.

Regan, Colston James,

"Nestleton," 14, Penerley Road, Catford, S.E.

Student at University College, London. Inter. B.Sc. (London), 1906. Working in Laboratory at Univ. Coll. for two and a half years.

J. Norman Collie.
N. T. M. Wilsmore.
William Ramsay.
Samuel Smiles.
R. W. Gray.
Charles M. Stuart.

Robinson, Robert, M.Sc.,

Field House, Chesterfield.

Research Student in Organic Chemistry, Manchester University (1851 Exhibition Scholar, 1906). Joint Author with Professor W. H. Perkin, F.R.S., of several papers in the *Proceedings*, and of the following memoirs in the *Transactions*: "Brazilin and Hæmatoxylin. VII." (*Transactions* of the Chemical Society, **91**, 1073—1103); "Brazilin and Hæmatoxylin. VIII." (*Transactions* of the Chemical Society, **93**, 489—517); "Brazilin and Hæmatoxylin. IX." (*Transactions* of the Chemical Society, **93**, 1115—1162, with Dr. Paul Engels); "The Synthesis and Constitution of Certain Pyranol Salts related to Brazilein and Hæmatein" (*Transactions* of the Chemical Society, **93**, 1085—1115, with M. R. Turner).

Harold B. Dixon.
G. H. Bailey.
W. H. Perkin.
J. F. Thorpe.
Norman Smith.

Rogers, Herbert,

Stenning House, Cobwell Road, Retford, Notts.

Works Chemist. Received training in Chemistry at East London, West Ham, and East Ham Technical Colleges. Five year Assistant

Chemist to Western Electric Co., North Woolwich, and for two years past Chemist to the Northern Rubber Co., Retford, Notts.

Francis Martin.
H. H. Ashdown.
A. E. Dunstan.
C. Schlienger.
Wesley Lambert.
A. H. Mundey.
H. Heron Smith.
R. L. Smith.

Sageman, Philip John,

160, Brecknock Road, London, N.

Analyst, Government Laboratory. Seven years' experience in Government Laboratory under Dr. Thorpe, F.R.S., and Mr. E. Grant Hooper, F.I.C. Contribution (*Trans. Chem. Soc.*, 1907): "Molecular Aggregation in Solution, etc." (Holmes and Sageman).

T. E. Thorpe.
E. Grant Hooper.
William A. Tilden.
M. O. Forster.
James C. Philip.
G. T. Morgan.

Schulten, J. H. Charles,

4, Pollock Street, Calcutta.

Proprietor of Analytical and Consulting Laboratory. Doctor Philosophiae, Erlangen, 1895. Dissertation: "Beiträge zur Kenntnis fester Lösungen"; "Manures: Their Action, Composition, and Use," *Gardening and Planting*, 1902; "Soil Analysis," *Planters' Gazette*, 1903; "New Method of Detecting Rosin in Shellac" (not yet published); in preparation: "The Use of Manures."

Paul Brühl.
David Hooper.
W. H. Arden Wood.
E. Sommerfeldt.
William Tate.

Segaller, David,

69, Dover Road, Wanstead Park, E.

Science Master, East Ham Technical College. A.R.C.S. (Dublin). Works Chemist of Mercerising Company, Macclesfield. Then Chemistry Master, Blackburn Grammar School. Now Science Master, East Ham Technical College. Studied with Prof. Lunge at Zurich.

W. N. Hartley.
G. Lunge.
W. J. Pope.
W. H. Perkin.
W. H. Barker.
A. E. Dunstan.

Stevenson, James Thomas,

67, Surrey Street, Sheffield.

Partner in the firm of A. H. Allen & Partners, Analytical Chemists.

G. E. Scott-Smith.
S. Ernest Melling.
John Evans.
Otto Hehner.
J. Carter Bell.

Varley, Reginald Wells,

Glenroy, 12, Mill Hill Road, Derby.

Analytical Chemist. Fourteen years Analytical Chemist to the Leeds Forge Co., 2½ years Chief Chemist to the Monkbridge Iron Co., 2 years Chief Chemist to the Fitzwilliam Hemsworth Co., 6 months Chief Chemist to the Clay Cross Co., and then engaged by Sir Francis Ley, Bart., as Chief Chemist to Ley's Malleable Castings Co., Vulcan Ironworks, Derby; sometime Lecturer in Metallurgy.

Harry W. Dixon.
B. A. Burrell.
Harry J. Unwin.
Herbert Eccles.
Arthur W. Cooke.

Warwick, Guy Ransom,

5 and 6, Fowkes Buildings, Great Tower Street, London, E.C.

Consulting and Analytical Chemist, especially as applied to Brewing, Distilling, and Malting. B.A. degree Cambridge, Natural Science Tripos; subjects: Chemistry, Physics, Botany, and Geology. Joint author of research on "The Influence of Light and Spectral Colours on the Sporulation and Vitality of Yeast."

Horace T. Brown.
M. M. Pattison Muir.
J. E. Purvis.
A. Hutchinson.
C. T. Heycock.

West, Percy Charles Henry,

40, The Green, Norton, Co. Durham.

Analytical Chemist. For three years a student in the laboratories of University College, London, during part of which period engaged in research; now and for the past five years engaged as works chemist. Contributor to technical journals.

J. Norman Collie.
N. T. M. Wilsmore.
William Ramsay.
Samuel Smiles.
A. W. Stewart.

Wild, Thomas Jabez,

Scott's Laboratories, Southall, Middlesex.

Pharmaceutical Chemist, Analyst, Member of the Pharmaceutical Society. For 2 years student at the Pharmaceutical Society's School

(1898–1899); passed Minor and Major examinations. Attended lectures on Chemistry, and studied Practical Chemistry at above School under Professor Collie. For 2 years in Hong Kong, Assistant Government Analyst under Mr. Frank Browne, F.C.S. For 1 year in Hong Kong, Acting Government Analyst (1899–1902). For 5½ years Analytical Chemist to Messrs. Scott & Browne, Ltd., Southall (May, 1903, to present date).

Frank Browne.	William Forster.
J. Norman Collie.	Horace Finnemore.

Arthur Lapworth.

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PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 25. No. 352.

Thursday, February 18th, 1909, at 8.30 p.m., Sir William Ramsay, K.C.B., F.R.S., President, in the Chair.

The President referred to the loss sustained by the Society in consequence of the death of three Honorary and Foreign Members, Professor Wolcott Gibbs (elected May 3rd, 1866 : deceased, Dec. 9th, 1908), Professor Emil Erlenmeyer (elected Feb. 1st, 1883 : deceased, Jan., 22nd, 1909), and Professor Julius Thomsen, F.R.S. (elected May 18th, 1876 : deceased, Feb. 13th, 1909). The death of Professor W. H. Hudleston, F.R.S., was also announced.

The President stated that the Council had recommended Professor Dr. Georg Lunge as an Honorary and Foreign Member, and that his election would be balloted for at the next Ordinary Scientific Meeting of the Society. Fellows wishing to participate in the forthcoming Celebration of Professor Lunge's 70th birthday on Sept. 15th., 1909, should forward their subscriptions to Professor E. Bosshard, Eidgenössisches Chemiegebäude, Zürich.

Messrs. D. Avery, W. C. Birch, H. Green, and H. Main were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs. :

Hugh Garner Bennett, M.Sc., 13, Spring Grove Terrace, Leeds.
Frank Playfair Burt, B.Sc., Elmhyrst, Weston-super-Mare.

Reginald Cyril Herbert Cooke, 17, St. Edmund's Terrace, Regent's Park, N.W.

Henry Jermain Maude Creighton, M.A., Halifax, Nova Scotia, Canada.

Philip Henry Crewe, Glencairn, Woods Moor, Stockport.

John Frederick Haws, Parkfield Villa, Newton-by-Frankby, Cheshire.

Reginald Vernon Hickinbotham, 144, West Street, Maritzburg, Natal.

Arthur Edwin Tate, B.Sc., Gladstone House, Salter Row, Pontefract.

Francis Lawry Usher, B.Sc., 18, Clifton Park, Bristol.

The selection by the Council of Professor F. S. Kipping, F.R.S., as Longstaff Medallist for 1909 was announced, the presentation to be made at the Annual General Meeting.

It was stated that the following changes in the Officers and Council were proposed by the Council:

President to retire: Sir William Ramsay, K.C.B.

Vice-Presidents to retire: Dr. R. Messel and Prof. W. H. Perkin.

Ordinary Members of Council to retire: Dr. H. A. D. Jowett, Dr. F. E. Matthews, Dr. W. J. Sell, Dr. J. Wade.

As President: Prof. Harold B. Dixon.

As Vice-Presidents who have filled the office of President: Prof. H. E. Armstrong, Prof. A. Crum Brown, Sir William Crookes, Sir James Dewar, Dr. A. G. Vernon Harcourt, Prof. R. Meldola, Dr. H. Müller, Prof. W. Odling, Sir William Ramsay, Prof. J. Emerson Reynolds, Sir Henry E. Roscoe, Dr. W. J. Russell, Prof. T. E. Thorpe, and Prof. W. A. Tilden.

As Treasurer: Dr. Alexander Scott.

As Hon. Secretaries: Dr. M. O. Forster and Prof. Arthur W. Crossley.

As Foreign Secretary: Dr. Horace T. Brown.

As Vice-Presidents: Prof. J. Campbell Brown, Prof. J. N. Collie, Dr. J. J. Dobbie, Prof. F. S. Kipping, Sir A. Pedler, Prof. James Walker.

As New Ordinary Members of Council: Prof. W. A. Bone, Mr. C. E. Groves, Dr. G. T. Morgan, Dr. A. E. H. Tutton.

Dr. Arthur Harden, Dr. V. H. Veley, and Dr. J. A. Voelcker were elected Auditors to Audit the Society's Accounts.

A ballot for the election of Fellows was held, and the following were subsequently declared elected:

George Henry Joseph Adlam, B.A.
Hubert Brunskill.
Arthur Clayton, B.Sc.
Herbert Edwin Cocksedge, B.A., B.Sc.
Alfred Bertram Coles, M.A.
John Charles Jesser Coope.
Frederick Percy Dunn, B.Sc.
Frederick Ferraboschi.
John Thomas Fox.
Arthur Gordon Francis, B.Sc.
John Thomas Furnell.
Ross Aiken Gortner, M.A., B.Sc.
John Wilberforce Green.
Alfred George Cooper Gwyer, B.Sc., Ph.D.
Robert Main Harland.
Walter Norman Haworth, M.Sc.
Eric Hayward.
Frank Higson.
James Henry Hoseason.
Ralph Hough.
Robert Ernest Jackson.
John Hugh Jeffery.
Henry Humphreys Jones.
Horace Keeble.
Joseph Leedham.
John Esson McGillvray, M.A.
William George Martin, B.Sc.
Percy May.
William Norton Morley, B.Sc.
Frederick Hubert Painter, B.Sc.
Joseph Allen Pickard, B.Sc.
Frank George Pope.
Colston James Regan.
Robert Robinson, M.Sc.
Herbert Rogers.
Philip John Sageman.
J. H. Charles Schulten, Ph.D.
David Segaller.
James Thomas Stevenson.
Reginald Wells Varley.
Guy Ransom Warwick, B.A.
Percy Charles Henry West.
Thomas Jabez Wild.

Of the following papers, those marked * were read:

*45. "A study of some asymmetric compounds."
By Frederic Stanley Kipping.

When a *dl*-acid is treated with a *d*-base, the product is a mixture of the *d*A*d*B- and *l*A*d*B-salts, and when a *d*-acid is combined with a *dl*-base, the components of the product are *d*A*d*B and *d*A*l*B. If therefore A and B represent a particular acid and a particular base respectively, and *dl*-A may be resolved with the aid of *d*-B, it might be inferred that *dl*-B could also be resolved with the aid of *d*-A. The *d*A*d*B-component is common to both original products, and as *l*A*d*B and *d*A*l*B are enantiomorphously related and have the same solubility in any given optically inactive solvent, the observed difference in solubility between *d*A*d*B and *l*A*d*B should also be effective in the case of *d*A*d*B and *d*A*l*B.

Now *dl*-sulphobenzylethylpropylsilicyl oxide may be resolved with *d*- (or with *l*-)methylhydrindamine (Trans., 1908, **93**, 457); experiments showed, however, that *dl*-methylhydrindamine could not be resolved with the aid of *d*-sulphobenzylethylpropylsilicyl oxide under similar conditions.

dl-Methylhydrindamine may be resolved by fractionally crystallising its *d*-hydrogen tartrate from water (Tattersall, Trans., 1904, **85**, 169); it is now shown that *dl*-tartaric acid may be resolved with *d*-methylhydrindamine under similar conditions, and that both the *d*A*d*B- and the *l*A*d*B-components may be isolated in one series of crystallisations.

dl-Hydrindamine cannot be resolved by fractionally crystallising its *d*-mandelate from water; *dl*-mandelic acid, however, is very easily resolved by fractionally crystallising from water its salt with *d*-(or with *l*-)hydrindamine.

These results seem to show that partly racemic molecules exist in solution.

DISCUSSION.

Mr. A. E. DUNSTAN agreed with Prof. Kipping that the physico-chemical evidence for the existence of racemic compounds in solution was slight, owing to the dissociation of these substances, but he pointed out that the results published by Clerk Ranken and Taylor, Stewart, Dunstan and Thole, all indicated that undoubtedly there was a small difference between the physical properties of the racemic and the active compound when dissolved. Moreover, these differences were consistent and increased with the concentration.

*46. "The decomposition and sublimation of ammonium nitrite."

By Prafulla Chandra Rây.

When an aqueous solution of ammonium nitrite is heated in a vacuum at about 37—40°, only a very small portion of the salt decomposes according to the equation: $NH_4NO_2 = 2H_2O + N_2$; the main bulk of the salt crystallising out. If the temperature is then gradually raised to 70°, slow decomposition continually proceeds according to the above equation, but the major portion sublimes unchanged. When this sublimate is heated by means of a naked flame, the gaseous products are nitrogen and nitric oxide, the latter often amounting to as much as 6 per cent.

DISCUSSION.

Dr. DIVERS remarked on the interest attached to the crystallisation of ammonium nitrite from its aqueous solution and of the sublimation of a salt hitherto supposed to be too unstable for these operations to be possible. The generation of much nitric oxide when the sublimed salt was vaporised and further heated seemed to indicate the occurrence of a decomposition tending to that production of hydrazine which Professor Rây had looked for: $2NH_4NO_2 = N_2H_4 + 2H_2O + 2NO$, the elements of the hydrazine appearing as ammonia and nitrogen.

Dr. Veley concurred with the author that ammonium nitrite in solution is best prepared by the decomposition of silver nitrite and ammonium chloride. It was a most interesting point that such a solution could be evaporated in a vacuum without decomposition, and that the ammonium nitrite could not only be crystallised out, but even purified by sublimation.

The observation was remarkable that if the conditions were such that the solid salt decomposed, then nitric oxide in a small proportion was formed in addition to nitrogen. Blanchard (*Zeitsch. physikal. Chem.*, 1902, **41**, 681; and *ibid.*, 1905, **51**, 117) had shown that when an aqueous solution containing potential ammonium nitrite is heated under atmospheric pressure, nitric oxide is formed in about the same proportion as that found by the author, but on reduction of pressure the proportion is reduced to *nil.* It would thus appear that the solid salt and aqueous solutions give the same result, although under reverse conditions.

*47. "The estimation of hydroxyl derivatives in mixtures of organic compounds." By Harold Hibbert.

Hibbert and Sudborough's method (Trans., 1904, **85**, 933) for the estimation of hydroxyl groups in carbon compounds can be applied with equal success to mixtures of hydroxyl derivatives with other organic compounds, for example, ketones, esters, nitriles, etc. It is necessary to take rather more of the Grignard reagent than is sufficient to combine with both substances.

In this way the author has been able to estimate α-naphthol in presence of various ketones, ethyl benzoate, methyl hydrogen succinate, and acetonitrile, as well as chloral in a mixture of this with acetone.

48. "A simple method for determining the chemical affinity of organic substances." By Harold Hibbert.

The author has shown (preceding paper) that hydroxyl derivatives can be estimated in presence of ketones if excess of the Grignard reagent is employed. If now a quantity of the latter is taken, insufficient to combine with both, it is obvious that a partition of the reagent between the two substances will take place, and the amount of methane evolved will depend on their relative masses and reaction velocities, assuming, of course, that all the products (apart from the methane) remain in solution. The latter condition is fulfilled by working in phenetole solution. By taking the same hydroxyl compound, mixing it with equimolecular quantities of various ketones, and using the same (insufficient) amount of magnesium methyl iodide solution, it is thus possible to measure the relative reaction velocities of the ketones towards the reagent, since these are indirectly proportional to the amounts of methane evolved. The method serves in this way as a means for determining the chemical affinity of organic compounds.

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* The author suggests using the term *affinergy* (compounded from *affin*-ity and en-*ergy*; German equivalent = affinergie) as a substitute for Michael's *chemical potential* (*Annalen*, 1908, **363**, 21) in order to avoid confusion with the physical conception of potential (as in electrical potential), with which it has nothing in common.

The relative affinities (using α-naphthol) of the following ketones have already been determined: dimethyl, methyl ethyl, and diethyl ketone; aceto- and benzo-phenone.

DISCUSSION.

Dr. LAPWORTH asked if the author had fully considered his assumption that velocity of reaction in non-reversible changes might be taken as a measure of affinity. Scientists were agreed that changes could only occur spontaneously when a diminution in potential thereby resulted, but at present this principle, whilst often serving to indicate the direction of change in a chemical system, was difficult to develop for irreversible changes, and the determination of affinity seemed hardly satisfactory except in such cases where equilibrium conditions could be ascertained.

Dr. SENTER said that in his opinion the reactivity of a chemical system could best be expressed, with van't Hoff, by means of the equation:

Reaction Velocity = Driving Force/Resistance.

The driving force was the "chemical affinity" and depended on the free energy of the system, which could be calculated, in a perfectly definite way, from equilibrium measurements. The reaction velocity might be enormously affected by slight changes in the medium or by catalysts, neither of which could, in general, modify to any great extent the free energy (or the chemical affinity). The fact that the free energy and the reaction velocity are affected so differently by reagents allowed to some extent of their investigation separately, and therefore this method of regarding the matter seemed to possess distinct advantages.

The PRESIDENT remarked that it is essential to distinguish between an energy and one of the factors of an energy:

just as Heat Energy = Temperature × Entropy,
and as Electric Energy = Electric potential × Electric quantity,
so Chemical Energy = Chemical Affinity × Chemical quantity.

Now as chemical quantity is proportional to electric quantity (as is proved by Faraday's law), it follows that chemical and electric affinity must also be proportional. Therefore, by determining electric potential, chemical affinity is measured.

The word "affinergy" appears to be confusing, inasmuch as it combines the conception of a factor of an energy with the energy itself.

*49. "Chlorine generated by potassium permanganate: its preparation and purity." By Edgar Wedekind and Samuel Judd Lewis.

The method of preparing chlorine by dropping concentrated hydrochloric acid on crystals of potassium permanganate, which was suggested by Graebe (*Ber.*, 1902, **35**, 43), is stated to yield the gas free from oxides of chlorine, but no experimental proof of this is given by that author.

The purity of the gas has now, however, been ascertained by the following experiments: (1) On passing the gas through sulphuric acid no reddish coloration is produced, showing the absence of chlorine peroxide. (The formation of chlorine monoxide is improbable, as this would be at once decomposed by the hydrochloric acid.) (2) 2·11 Grams of tin were heated to dull redness in a stream of the gas; the residue weighed only 0·7 milligram. (3) The gas is completely absorbed by mercury. (4) A definite volume of the gas was absorbed by a solution of 15 grams of potassium iodide in water, and the iodine liberated was titrated with sodium thiosulphate solution, of which 168·70 c.c. (mean of four determinations) were required, whereas in a corresponding experiment with chlorine, generated from pure manganese dioxide and hydrochloric acid (and assumed to be free from oxides of chlorine, carbon dioxide, etc.), 168·67 c.c. of thiosulphate solution (mean of six determinations) were used.

Discussion.

Dr. Scott pointed out that, as potassium permanganate often contains small quantities of chlorate, chlorine prepared by its means is peculiarly liable to be contaminated with traces of chlorine oxides. The only safe test for the presence of these is to absorb the gas in a neutral solution of potassium iodide, and then decolorise it exactly by means of sodium thiosulphate; if, on adding to the colourless solution pure dilute hydrochloric acid, no iodine is liberated, then the chlorine may be regarded as quite free from its oxides, but any iodine liberated is exactly equivalent to the combined oxygen, since, in neutral solution, it goes to form iodate in accordance with the following equations:

$$3Cl_2O + 7KI = 3I_2 + KIO_3 + 6KCl \qquad 3Cl_2 = 3I_2$$
$$3Cl_2O + 12KI + 6HCl = 6I_2 + 3H_2O + 12KCl \qquad 3(O) = 3I_2$$

and

$$6ClO_2 + 10KI = 3I_2 + 4KIO_3 + 6KCl \qquad 3Cl_2 = 3I_2$$
$$6ClO_2 + 30KI + 24HCl = 15I_2 + 12H_2O + 30KCl \qquad 6O_2 = 12I_2.$$

Neither of the authors' assumptions: (*a*) that hypochlorous anhydride must be absent, because of the presence of a large excess of hydrochloric acid, or (*b*) that chlorine peroxide could not be present, as the sulphuric acid by which the gas was dried did not acquire a reddish colour, was justified. What their experiments did prove was that the gas thus prepared was of the same order of purity as that from hydrochloric acid and manganese dioxide.

50. "The isolation of the aromatic sulphinic acids." By John Thomas.

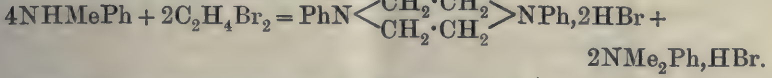
The aromatic sulphinic acids are characterised, as a class, by forming ferric salts which are insoluble in water and fairly concentrated mineral acids; this property can be usefully applied in the separation of these acids from the solutions in which they are produced. The ferric salts of benzenesulphinic, *o*- and *p*-toluenesulphinic, and *α*- and *β*-naphthalenesulphinic acids have been prepared and characterised, and simple methods indicated for converting them into the corresponding sulphinic acids, sulphonyl chlorides, and sulphonamides.

51. "Analytical investigation of zirconium metal." By Edgar Wedekind and Samuel Judd Lewis.

In view of zirconium having not yet been obtained in a pure condition, and of the lack of analytical data regarding the composition of the specimens obtained by various workers, the authors have worked out methods of analysis which make it possible to determine the proportions of the most common impurities. The zirconium existing in the free state is separated as the tetrachloride from that in combination with oxygen by burning the substance in pure chlorine; in this way the proportion of oxygen is determined directly. Nitrogen is estimated by a method similar to that of Kjeldahl; carbon by combustion of the metal in oxygen at very low pressure, and subsequent absorption of the carbon dioxide produced.

52. "The action of ethylene dibromide on monomethylaniline." By John Gunning Moore Dunlop and Humphrey Owen Jones.

By the interaction of two gram-molecules of monomethylaniline with one gram-molecule of ethylene dibromide, diphenylpiperazine (m. p. 163°) is formed by a reaction represented by the equation:



$$4NHMePh + 2C_2H_4Br_2 = PhN\left<\begin{matrix}CH_2\cdot CH_2\\ CH_2\cdot CH_2\end{matrix}\right>NPh,2HBr + 2NMe_2Ph,HBr.$$

When four gram-molecules of monomethylaniline are used instead of two in this interaction, diphenyldimethylethylenediamine,

$$NMePh\cdot CH_2\cdot CH_2\cdot NMePh,$$

melting at 47°, is produced.

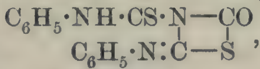
53. "Salicylidene-*m*-toluidine, a new phototropic compound; salicylideneamines: salicylamides." By Alfred Senier and Frederick George Shepheard.

In continuation of previous work on acridine synthesis, a series of new salicylideneamines and salicylamides have been prepared. Among these, *salicylidene*-m-*toluidine* has special interest, as it exhibits phototropy (Marckwald, *Zeitsch. physikal. Chem.*, 1899, **30**, 140). On crystallisation from its solutions, the crystals are pale yellow, but when exposed to sunlight the colour changes quickly to deep orange, and this colour change is reversed, although more slowly, when the crystals are placed in the dark. This reversible reaction is due to light waves of high refrangibility; it does not take place in solution, and the sensibility of the compound remains unimpaired after at least a month's time. No evidence could be obtained of triboluminescence or phosphorescence. Salicylidene-*m*-toluidine behaves in this respect like the anhydrous chloride of quinoquinoline and β-tetrachloro-α-ketonaphthalene studied by Marckwald. It is similar also to the fulgenic acid compounds investigated by Stobbe (*Annalen*, 1908, **359**, 1). Probably phototropy in this instance, as is supposed to be the case in others, depends on the existence of two stereo- or other isomerides formed respectively under the influence of short or long waves of light.

54. "The action of ethyl carbamate on esters of organic acids and mustard oils." By Siegfried Ruhemann and John Gillies Priestley.

Ethyl phenylpropiolate does not form an additive product with ethyl sodiocarbamate, but condenses with it to yield *ethyl phenylpropiolylcarbamate*, $C_6H_5C{⋮}C{\cdot}CO{\cdot}NH{\cdot}CO_2Et$. This reaction has been applied to the preparation of acyl derivatives of ethyl carbamate from esters of fatty and fatty-aromatic acids. In this way, also, *ethyl formylcarbamate*, $CHO{\cdot}NH{\cdot}CO_2Et$, has been obtained, which is readily hydrolysed by mineral acids, even in the cold.

The esters of benzenecarboxylic acids form either only very small quantities of the acyl derivatives of ethyl carbamate, as with ethyl benzoate, or no trace of the acyl carbamate, as with ethyl *o*-phthalate.

Phenylthiocarbimide reacts with ethyl sodiocarbamate to form carboxyethylphenylthiocarbimide, $NH(CO_2Et){\cdot}CS{\cdot}NH{\cdot}C_6H_5$ (see Doran, *Trans.*, 1896, 69, 326), and a yellow compound having the formula  $\begin{array}{r} C_6H_5{\cdot}NH{\cdot}CS{\cdot}N{-}CO \\ C_6H_5{\cdot}N{:}C{-}S \end{array}$, which is *anhydro-diphenyldithiobiuretcarboxylic acid*. It forms colourless sodium and potassium salts, and is readily decomposed by alkalis. Allylthiocarbimide yields with ethyl sodiocarbamate a substance, $C_9H_{11}ON_3S_2$, with similar properties to those of the former compound.

55. "The hydrolysis of amygdalin by emulsin. Part III. Synthesis of *d*-benzaldehydecyanohydrin." By Samuel James Manson Auld.

The assumption generally made that benzaldehydecyanohydrin must be formed as an intermediate product of the decomposition of amygdalin by emulsin is objected to, and evidence has been brought forward showing that an asymmetric synthesis of *d*-benzaldehydecyanohydrin takes place under the influence of emulsin, and that its formation in this manner proceeds more rapidly than its formation during the hydrolysis of amygdalin by emulsin. Emulsin can also induce the formation of an optically active hydroxybenzaldehydecyanohydrin from hydroxybenzaldehyde and hydrocyanic acid.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Fischer, *Emil.* Untersuchungen über Kohlenhydrate und Fermente (1884—1908). pp. viii + 912. Berlin 1909. (*Recd.* 21/1/09.)
From the Author.

Guttmann, *Oscar.* The manufacture of explosives. Twenty years' progress. Four Cantor Lectures delivered at the Royal-Society of Arts in November and December, 1908. pp. viii + 84. ill. London 1909. (*Recd.* 17/2/09.)
From the Publishers: Messrs. Whittaker & Co.

Gordon Memorial College, Khartoum. Third report of the Wellcome Research Laboratories. pp. 477. ill. London 1908. (*Recd.* 15/2/09.) From the Director.

—— Supplement to the third report. Review of some of the recent advances in tropical medicine. By *Andrew* **Balfour** and *R. G.* **Archibald.** pp. 251. London 1908. (*Recd.* 15/2/09.)
From the Director.

Johnson, *Charles Morris.* Rapid methods for the chemical analysis of special steels, steel-making alloys, and graphite. pp. vi + 221. New York 1909. (*Recd.* 12/2/09.)
From the Publishers: Messrs. John Wiley & Sons.

Linnean Society of London. The Darwin-Wallace Celebration held on Thursday, 1st July, 1908. pp. viii + 134. ill. London 1908. (*Recd.* 15/2/09.) From the Society.

Senter, *George.* Outlines of physical chemistry. pp. xvii + 369. ill. London 1909. (*Recd.* 26/1/09.)
From the Publishers: Messrs. Methuen & Co.

Stewart, *Alfred Walter.* Recent advances in organic chemistry. pp. xv + 296. London 1908. (*Recd.* 25/1/09.) From the Author.

Symons, *Brenton.* Genesis of metallic ores and of the rocks which enclose them. pp. xxxiii + 494. ill. London 1908. (*Recd.* 19/1/09.)
From the Author.

Woburn Experimental Fruit Farm. Tenth report. By the **Duke of Bedford** and *Spencer U.* **Pickering.** pp. iv + 50. London 1909. (*Recd.* 26/1/09.) From the Authors.

ANNIVERSARY DINNER.

It has been arranged that the Fellows of the Society and their friends shall dine together at the Whitehall Rooms, Hotel Metropole, at 6.30 for 7 o'clock, on Thursday, March 25th, 1909 (the day fixed for the Annual General Meeting).

The price of the tickets will be One Guinea each, including wine.

All applications for tickets must be received not later than Thursday, March 18th next.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, made payable to "Mr. S. E. Carr" and addressed to the Assistant Secretary, Chemical Society, Burlington House, W.

At the next Ordinary Scientific Meeting, on **Thursday**, March **4th**, 1909, there will be a ballot for the election of an Honorary and Foreign Member, and the following papers will be communicated:

"The action of anhydrosulphuric acid on triphenylsilicol." By G. Martin and F. S. Kipping.

"The ignition temperatures of gases." By H. B. Dixon and H. F. Coward.

"Diazohydroxylamino-compounds and the influence of substituting groups on the stability of their molecules." By N. L. Gebhard and H. B. Thompson.

"Tetraketopiperazine. Part II." By A. T. de Moulpied and A. Rule.

"The alkaloids of *Senecio latifolius*." By H. E. Watt.

"The miscibility of the pyridine bases with water and the influence of a critical-solution point on the shape of the melting-point curve." By O. Flaschner.

"An interpretation of the Hantzsch-Werner hypothesis." By M. O. Forster and F. P. Dunn.

"The triazo-group. Part IX. Transformation of cinnamoylazoimide into cinnamenylcarbimide (cinnamenyl *iso*cyanate)." By M. O. Forster.

"The preparation of dichlorocarbamide." By F. D. Chattaway.

"The interaction of methylenediamines or methyleneanilines and carbimides or thiocarbimides; thiotetrahydroquinazolines, methylenecarbamides, dicarbanilidomethylenediamines and their homologues." By A. Senier and F. G. Shepheard.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 12/3/09

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 353.

Thursday, March 4th, 1909, at 8.30 p.m., Sir WILLIAM RAMSAY, K.C.B., F.R.S., President, in the Chair.

Messrs. A. G. C. Gwyer, R. E. Jackson, G. T. Morgan, W. N. Morley, C. S. Mummery, C. J. Regan, M. S. Salamon, and A. W. Stewart were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Harry Livsey, 54, Pemberton Street, Old Trafford, Manchester.
Robert Cecil Owen, B.Sc., 89, Foregate Street, Chester.
Norman Scott Rudolf, M.Sc., Bangalore, India.
Henry Llewellyn Smith, B.Sc., 23, Ellingham Road, Shepherd's Bush, W.
Arthur Percy Strohmenger, Bridgebank, Harrow-on-the-Hill.
George Bilderbeck Walker, Vale House, Trafalgar Road, Greenwich, S.E.

Dr. DIVERS gave notice that, at the Annual General Meeting of the Society on March 25th next, he would move the adoption of a new Bye-law, to run as follows:

XIII *bis.—On Ascertaining the Will of the Society by means of Voting Papers.*

The President, either on his own motion or on a written requisition by the Council or by fifty Fellows, shall proceed to ascertain the will of the Society as to any suggested change in the Bye-laws or in the administration of these laws by the Council, by causing to be delivered, along with the Proceedings or separately, a notice to each Fellow of the change proposed, together with a voting paper upon it, to be filled in by the Fellow and returned to the Secretaries not later than a prescribed date. After that date, the results of the voting shall be counted by the Secretaries and two Scrutineers, appointed by the President, and be reported by him to a Council Meeting and to a General Meeting, upon which the Council shall proceed to act in accordance with the majority of votes, as being the expression of the will of the majority.

The PRESIDENT read the names of the Fellows recommended by the Council for election as Officers and as Ordinary Members of Council of the Society.

A Ballot for the election of an Honorary and Foreign Member was held, and the PRESIDENT declared subsequently that Prof. Dr. Georg Lunge, of Zürich, had been unanimously elected.

Of the following papers, those marked * were read :

*56. "The action of fuming sulphuric acid on triphenylsilicol." By Geoffrey Martin and Frederic Stanley Kipping.

Tetraphenylsilicane is decomposed by fuming sulphuric acid, giving sulphonic derivatives of benzene (Kipping and Lloyd, *Trans.*, 1901, **79**, 449), and phenylbenzylethylpropylsilicane is decomposed by sulphuric acid, the phenyl group being eliminated in the form of benzene (Kipping, *Trans.*, 1907, **91**, 209).

These facts led the authors to doubt the existence of the "triphenylsilicoltrisulphonic acid" recently described by Ladenburg (*Ber.*, 1907, **40**, 2274 ; 1908, **41**, 966), and a repetition of his experiments leads to the conclusion that his acid is not only a mixture, but also that it does not contain any appreciable quantity of triphenylsilicoltrisulphonic acid.

Even when triphenylsilicol is treated with fuming sulphuric acid at −10°, the greater part, if not the whole, of the silicol is decomposed and benzenesulphonic acid is formed, whereas at higher temperatures benzenedisulphonic acid is produced ; no compound containing silicon was isolated, but evidence pointing to the presence of diphenylsiliconedisulphonic acid, $SiO(C_6H_4 \cdot SO_3H)_2$, in the crude product was obtained.

l-*Menthylamine benzenesulphonate*, $C_6H_5 \cdot SO_3H, C_{10}H_{21}N$, forms colourless needles, melts at 223—226°, and is readily soluble in water, alcohol, or chloroform, but sparingly soluble in ethyl acetate.

1-*Menthylamine benzenedisulphonate*, $C_6H_4(SO_3H)_2,(C_{10}H_{21}N)_2$, melts at 212°, and is readily soluble in ethyl acetate, alcohol, or water, but insoluble, or nearly so, in ether.

*57. "The ignition-temperatures of gases."

By Harold Baily Dixon and Hubert Frank Coward.

The temperature to which two gases must be heated in order that, when brought into contact, they will inflame immediately has been determined by passing an inflammable gas up a tube, terminating in a nozzle, fixed in the centre of a second tube conveying a current of air or oxygen, and electrically heated. Thus no reaction occurred during the preliminary heating of the gases. The temperature of the gas 2 mm. below the nozzle was measured by means of a protected thermo-junction.

The ignition-temperature of hydrogen thus obtained was constant, within 10°, under variation of the following circumstances:

(1) The rates of flow of the gases, within wide limits.

(2) The size, material, and surface condition of the jet and of the walls of the furnace.

(3) The rate of heating of the furnace.

(4) The position of the thermo-junction, either inside or just outside the nozzle.

The ignition-temperature was at first decreased some 20° by increasing the diameter of the outer tube, but a limit was then reached when doubling the diameter produced no further decrease.

The ignition-temperature was raised 5° by working under half an atmosphere pressure, but decreased by 30° under a pressure of two atmospheres.

The ignition-temperature of hydrogen in air is the same as in oxygen.

The results obtained at atmospheric pressure are given in the following table. The paraffins and ammonia gave numbers varying

	Ignition-temperature			
	in oxygen.		in air.	
Gas.	Between.	Mean.	Between.	Mean.
Hydrogen	580—590°	585°	580—590°	585°
Carbon monoxide (moist)	637—658	650	644—658	651
Cyanogen	803—818	811	—	—
Ethylene	500—519	510	542—547	543
Acetylene	400—440	428 (?)	406—440	429
Hydrogen sulphide	220—235	227	346—379	364
Methane	556—700	—	650—750	—
Ethane	520—630	—	520—630	—
Propane	490—570	—	—	—
Ammonia	700—860	—	—	—

with the rates of flow of the gases, as well as with the size of the furnace tube, so that their ignition-temperatures are not so clearly defined as those of hydrogen, carbon monoxide, and the other gases.

DISCUSSION.

The PRESIDENT asked whether the temperature of ignition would not be affected by varying the proportion of the gases; for example, if the rate of flow be so adjusted as to diminish the relative amount of oxygen, while keeping that of the hydrogen constant.

Professor DIXON replied that alteration of the proportion of the gases within wide limits had no effect on the ignition-temperature.

*58. "The alkaloids of Senecio latifolius."
By Henry Edgar Watt.

The author has made a chemical examination of *Senecio latifolius* (N.O. *Compositæ*), a poisonous plant which grows in South Africa, collected before flowering and also after flowering, and has isolated two new alkaloids of the formulæ $C_{18}H_{27}O_8N$ and $C_{18}H_{25}O_7N$ respectively, for which the names *senecifoline* and *senecifolidine* are proposed. The proportion of these substances present in the plant before flowering is equivalent to 1·20 per cent., whilst in the mature plant it only amounts to 0·49 per cent.

Senecifoline crystallises in colourless, rhombic plates, which melt at 194—195°, and has $[\alpha]_D$ $+28°8'$; it forms well-defined salts with nitric, hydrochloric, or hydriodic acids, and also an *aurichloride*. It can be decomposed by alkali into a hitherto undescribed dicarboxylic acid, $C_{10}H_{16}O_6$, which it is proposed to name *senecifolic acid*, and a new base, $C_8H_{11}O_2N$, for which the name *senecifolinine* is suggested.

Senecifolidine crystallises in colourless, rhombic plates, which melt at 212°, and has $[\alpha]_D$ $-13°56'$; it differs considerably from *senecifoline* in other physical respects, and forms salts corresponding with those mentioned above.

DISCUSSION.

Dr. WATT stated, in reply to Dr. Bywaters, that Professor Cushny had kindly undertaken to work out the pharmacology of the alkaloids, and had already reported that one of them was poisonous to animals.

*59. "An interpretation of the Hantzsch-Werner hypothesis."
By Martin Onslow Forster and Frederick Percy Dunn.

From an investigation of the behaviour towards diazomethane displayed by some typical oximes, the authors were led to suggest a possible explanation of the stereoisomerism occurring in this group of compounds.

Discussion.

Dr. **Flürscheim** suggested that Dr. Forster's interesting hypothesis might perhaps also apply to the diazo-compounds formulated by Hantzsch as *syn-* and *anti*-isomerides.

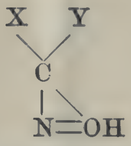
Dr. **Morgan** remarked that it would be of interest to know whether the supplementary valencies referred to by Dr. Forster were the ordinary valencies of oxygen and nitrogen indicated by the position of these elements in the periodic classification or the more elusive "Nebenvalenzen" postulated by Werner.

On the ordinary theory of valency, the isomeric diazo-derivatives fall into line with this conception of the structure of the *syn-* and *anti*-oximes, for the former series of isomerides contains the necessary grouping with an element of variable valency (shown in heavy type) contiguous to the double linking:

$$\mathrm{R{\cdot}N{:}\mathbf{N}{\cdot}OK}$$
$$\mathrm{R{\cdot}N{:}\mathbf{N}{\cdot}SO_3K}$$
$$\mathrm{R{\cdot}N{:}\mathbf{N}{\cdot}CN.}$$

In the third case the required supplementary valencies could be obtained by a rearrangement of the cyanogen group.

Mr. **Baly** asked Dr. Forster whether he had considered the expression



as the extreme phase arising from his formula. This would make the oxygen atom quadrivalent, but there appears to be no objection to this, seeing that Dr. Forster's own formula postulated a valency on the part of the oxygen supplemental to the two normal valencies. Dr. Forster's formula, moreover, would seem to require a supplemental valency on the part of the carbon in addition to the normal four.

*60. "The triazo-group. Part IX. Transformation of cinnamoylazoimide into cinnamenylcarbimide (cinnamenyl *iso*cyanate)." By Martin Onslow Forster.

The production of cinnamenylcarbimide when cinnamoylazoimide loses nitrogen in absence of water leads to the conclusion that other acyl azides owe their property of giving carbamates and carbamides with alcohols and amines respectively to intermediate formation of the respective carbimide.

*61. "Experiments on the Walden inversion. II. The interconversion of the optically active mandelic acids." By Alex. McKenzie and George William Clough.

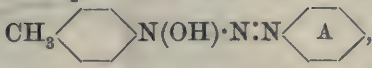
The preparation of *d*-phenylchloroacetic acid was described.

The following points have been investigated: action of water on *l*-phenylchloroacetic acid, action of water on salts of the optically active phenylchloroacetic acids, the displacement of chlorine in the active phenylchloroacetic acids by the amino-group, and the displacement of the amino-group in the active phenylaminoacetic acids by the hydroxyl group and by halogen groups. The interconversion of the active mandelic acids can be effected by a method different from that described previously, thus:

$$\begin{tikzcd}
d\text{-}C_6H_5\cdot CH(OH)\cdot CO_2H \arrow[d, "\text{(by }PCl_5\text{)}"] & l\text{-}C_6H_5\cdot CH(NH_2)\cdot CO_2H \arrow[l, dashed, "\text{(by }HNO_2\text{)}"'] \\
l\text{-}C_6H_5\cdot CHCl\cdot CO_2H \arrow[d, "\text{(by }NH_4OH\text{)}"] & d\text{-}C_6H_5\cdot CHCl\cdot CO_2H \arrow[u, "\text{(by }NH_4OH\text{)}"'] \\
d\text{-}C_6H_5\cdot CH(NH_2)\cdot CO_2H \arrow[r, dashed, "\text{(by }HNO_2\text{)}"'] & l\text{-}C_6H_5\cdot CH(OH)\cdot CO_2H. \arrow[u, "\text{(by }PCl_5\text{)}"']
\end{tikzcd}$$

The striking feature in each one of these changes is the large amount of racemisation which always occurs.

62. "Diazohydroxylamino-compounds and the influence of substituting groups on the stability of their molecules." By Norman Leslie Gebhard and Herbert Bryan Thompson.

Arylhydroxylamines react with diazonium salts to form diazohydroxylamino-compounds or azohydroxyanilides, a class of substances which may be looked upon as hydroxyl derivatives of the diazoamino-compounds, in which the imino-hydrogen atom of the latter is replaced by a hydroxyl group. The tautomeric phenomena shown by unsymmetrical diazoamino-compounds is not observed with the diazohydroxylamino-compounds. A series of these substances, derived from *p*-tolylhydroxylamine and various diazonium compounds, has been prepared with the object of examining the general properties of these little-known substances, and comparing the various compounds prepared with one another, with the view of determining the effect of substituting groups of various types and in different positions in the molecule on their general stability. The parent substance was benzenediazohydroxylamino-*p*-toluene, 

, and a number of derivatives of this containing various substituting groups in the ring A have been prepared. The substituting groups used were methyl-, bromo-, nitro-, and carboxyethyl, whilst attempts were made to prepare the corresponding sulphonic acid and hydroxyl derivatives.

63. "Tetraketopiperazine. Part II."
By Alfred Theophilus de Mouilpied and Alexander Rule.

The authors described the preparation and some of the reactions of tetraketopiperazine in a previous paper (*Trans.*, 1907, **91**, 176). Attempts have since been made to reduce the compound to a piperine derivative, but without success. Phosphorus pentachloride and phenylcarbimide are without action on the tetraketone.

The formation of coloured compounds during the preparation of the tetraketone had been noticed, and these are now found to be additive compounds of the sodium salt of tetraketopiperazine with sodium alcoholates.

They vary in colour from deep indigo-blue to bright purple, and are easily decomposed by water, but remain unchanged in dry ether.

64. "The miscibility of the pyridine bases with water and the influence of a critical-solution point on the shape of the melting-point curve." By Otto Flaschner.

The problem of the connexion between chemical constitution and mutual solubility of two liquids has been investigated in the case of the members of the pyridine and piperidine series combined with water. The width of the solubility ring for partly miscible liquids is taken as a comparable measure of the miscibility, whilst the miscibility of completely miscible pairs is defined by the width of that negative solubility ring which is obtained under a certain external influence, such as pressure or the solution of a third substance. The amount of this external action to be measured is that required to bring about under normal conditions the first appearance of two liquid phases. These considerations are illustrated by the miscibility of the three picolines and pipecolines with water.

The influence of the neighbourhood of a critical-solution point on the shape of the melting-point curve was discussed, and in the solutions of the zinc double salt of γ-picoline in the different aliphatic alcohols was found a convenient series of examples by means of which the analogy between the shape of a melting-point curve and that of an isotherm of a vapour in the neighbourhood of the critical point can be demonstrated.

65. "The preparation of dichlorocarbamide." By Frederick Daniel Chattaway.

When dichlorocarbamide is prepared by passing chlorine through a cooled concentrated aqueous solution of carbimide, a yield of about 25 per cent. of the theoretical can with care be obtained. Unless, however, the process is very rapidly carried out, with efficient cooling, the quantity which separates falls much below this maximum. The loss is mainly due to hydrolysis of the dichlorocarbamide under the influence of the hydrogen chloride formed in the substitution. If this hydrogen chloride is removed immediately it is formed by combining it with some basic substance, hydrolysis is to a large extent prevented, and, if suitable quantities are used, over 75 per cent. of the amount of dichlorocarbamide theoretically obtainable from the carbamide used can be isolated in a pure dry state.

Details of the procedure recommended, in which the hydrogen chloride is removed by zinc oxide, were described.

66. "Thiotetrahydroquinazolines, methylenecarbamides, dicarbanilinomethylenediamines, and their homologues." By Alfred Senier and Frederick George Shepheard.

The interaction of arylthiocarbimides with arylmethylenediamines at temperatures from 150° to 200° results in the formation of cyclic compounds: cyclic carbamides and quinazolines. When the para-position in the aryl group of either the diamine or the thiocarbamide, or both of them, is occupied, thiotetrahydroquinazoline derivatives and a diarylthiocarbamide are formed. In all other instances, using thiocarbimides, and in all instances where the oxygen analogues, carbimides, are employed, the experiments being conducted at the temperatures mentioned, unstable cyclic methylenecarbamides or thiocarbamides are probably formed, and at the same time a diarylcarbamide or thiocarbamide. That these unstable cyclic carbamides are actually formed, although they were identified only by the products of their hydrolysis, is rendered extremely probable by the fact that in two instances, employing a different reaction, namely, the substitution of methyleneaniline for a methylenediamine, the authors succeeded in isolating them and proving their instability.

At the ordinary temperature, the course of the reactions is in agreement with previous experiments; carbanilino- or thiocarbanilinomethylenediamines or their homologues are always formed (Senier and Goodwin, *Trans.*, 1901, **79**, 254; 1902, **81**, 283).

67. "The distillation of butter fat, cocoanut oil, and their fatty acids." By Kenneth Somerville Caldwell and William Holdsworth Hurtley.

The authors are of opinion that fats and fatty acids have no boiling points in the vacuum of the cathode light, but that for any particular substance a temperature can be selected at which evaporation occurs at a speed convenient for fractional distillation.

Butter fat, cocoanut oil, and their fatty acids were distilled in the vacuum of the cathode light. The lowest fraction obtained from butter fat distilled with the bath temperature at 250—270° and inner thermometer at 187—210°. Tributyrin distils rapidly with the bath temperature at 127° and inner thermometer at 107°. For this and other reasons, it is concluded that butter does not contain tributyrin. The iodine numbers yielded by the various fractions seem to indicate that there is little or no triolein in butter fat. Lauric acid forms at least 60 per cent. of the fatty acids in cocoanut oil, whilst it could not be detected in butter; this method of distillation enabled the authors to detect with ease the presence of 10 per cent. of cocoanut oil in butter. The presence of palmitic acid in cocoanut oil has been questioned by Ulzer (*Chem. Revue*, 1899, 203), but the authors isolated several grams of this acid from cocoanut oil.

68. "Note on the detection of white or ordinary phosphorus in the igniting composition of lucifer matches." By Thomas Edward Thorpe.

As the White Phosphorus Matches Prohibition Act, 1908, will throw upon Officers of Customs and the Inspectors under the Factory and Workshop Act, 1901, the duty of sampling importations of matches and of materials in use in match factories, the author has examined the methods by which the presence of ordinary phosphorus in the igniting composition of lucifer matches containing phosphorus sesquisulphide may be established, and he finds that the most direct and most certain test is to isolate the phosphorus as such, which is conveniently effected by gently heating the composition in a vacuum, when the phosphorus sublimes and may be readily recognised by its physical characteristics.

69. "Intramolecular rearrangement of the diphenylamine sulphoxides." (Preliminary note.) By Edward de Barry Barnett and Samuel Smiles.

When the yellow tetranitro-, 3 : 9-dinitro-, and *iso*dinitro-diphenylamine sulphoxides are treated with suitable reagents—for example, an alcoholic solution of hydrogen chloride—brick-red or chocolate-coloured, crystalline substances are formed. According to the conditions of the reactions, the dark-coloured compounds so obtained are either isomeric with the sulphoxides or differ from them by the content of a molecule of water. The evidence hitherto collected shows that these substances, although they are not of pronounced basic character, contain the ortho-quinonoid sulphonium structure, and this view is confirmed by the fact that the unsubstituted diphenylamine sulphoxide is readily converted by aqueous acids into salts of phenazothionium. The depression of the basic properties in the nitro-derivatives is explained by the influence exerted on the quadrivalent sulphur by the acidic substituents.

70. "A crystalline bleaching powder."

By Kennedy Joseph Previté Orton and William Jacob Jones.

A basic hydrated compound of calcium chloride and calcium hypochlorite, which separates on cooling moderately concentrated (about $2N$) solutions of bleaching powder, was described. This substance has been obtained in large, prismatic crystals, the properties of which closely resemble those of bleaching powder. On the other hand, from very highly concentrated solutions of bleaching powder (about $4N$), a hydrated calcium hypochlorite separates at low temperatures.

71. "The action of carbon dioxide on nitrites."

By Ernest Robert Marle.

The contradiction in the results obtained by Marie and Marquis (*Compt. rend.*, 1904, **138**, 367) and Meunier (*Compt. rend.*, 1903, **137**, 1264; compare also Papasogli, *Gazzetta*, 1881, **11**, 277; Moody, *Proc.*, 1903, **19**, 240) in investigating the action of carbon dioxide on nitrites seems to be partly due to the unsuitability of potassium iodide and starch as a test for traces of nitrites unless special precautions be taken.

Warington (*Chem. News*, 1885, **51**, 39) finds that one of the most delicate tests for nitrous acid is the coloration produced with α-naphthylamine (Griess).

Carbon dioxide, prepared from marble and hydrochloric acid, was washed by passing through water in two Drechsel bottles, and was then passed through 10 per cent. aqueous potassium nitrite in a Cloez washing bottle, the construction of which is such that it is unlikely that liquid will be mechanically carried over by the stream of gas. It was then passed into water or potassium carbonate for periods varying from one to six hours.

In every case the coloration with potassium iodide and starch seemed slightly greater than that produced by the reagents alone. With α-naphthylamine, a faint pink coloration resulted after a few minutes.

To guard against the possibility of mistaking nitrite, mechanically carried over, for nitrous acid, a dry Arnold absorption apparatus was inserted between the Cloez bottle and the final flask. A slight mist appeared on the inside of the absorption bulbs, which, when washed out with water, proved faintly acid to litmus, and with α-naphthylamine gave a full red colour, appearing in about three minutes. The water in the final flask was neutral (after boiling), and gave with α-naphthylamine a faint coloration, appearing in about fifteen minutes.

From the data in Warington's paper, the quantity of nitrogen (as nitrous acid) removed by one litre of carbon dioxide is probably less than one two-hundredth of a milligram. The reduction of very dilute potassium permanganate by the solution in the final flask leads to a similar figure.

72. "Estimation of primary, secondary, and tertiary amines. Part I." By John Joseph Sudborough and Harold Hibbert.

The method outlined by the authors some years ago (*Proc.*, 1904, **20**, 165) for the estimation of primary, secondary, and tertiary amines has been found capable of general application. Phenetole may be substituted for amyl ether as solvent. The procedure was identical with that followed by the authors in the estimation of hydroxyl groups in carbon compounds (*Trans.*, 1904, **85**, 933).

Quantitative results have been obtained with the following substances: phenyl-α-naphthylamine, phenyl-β-naphthylamine, ββ-dinaphthylamine, diphenylamine, ethylaniline, methylaniline, β-naphthylamine, *p*-toluidine, *p*-chloroaniline, dimethylaniline, diethylaniline, and tetramethyl-*p*-diaminodiphenylmethane.

73. "The condensation of ketones and aldehydes with the sodium derivative of ethyl cyanoacetate." By Walter Norman Haworth.

The author discussed the nature of the condensation of ethyl cyanoacetate with certain representative aldehydes and ketones.

74. "Experiments on the constitution of the aloins. Part I." (Preliminary note.) By Robert Robinson and John Lionel Simonsen.

In view of the recent publication of a memoir by Oesterle and Tisza (*Schweiz. Wochschr. Chem. Pharm.*, 1908, **46**, 701) on the subject of rhein, the authors communicated some of the results obtained during the last two years in connexion with an investigation of the constitution of the various aloins, and undertaken with the permission and assistance of Dr. Jowett.

The oxidation of the acetyl derivative of barbaloin with chromic acid leads to the formation of *diacetylrhein*, $C_{14}H_5O_2(OAc)_2 \cdot CO_2H$ (m. p. 245°), and other substances. The investigation and analysis of rhein and its derivatives have conclusively shown that this substance has the composition $C_{15}H_8O_6$, and is a *dihydroxyanthraquinonecarboxylic acid.*

This view is based on the following facts: (1) The substance has all the properties of an acid, and is soluble in the alkaline carbonates and even in sodium acetate. It yields a *methyl* ester, $C_{14}H_5O_2(OH)_2 \cdot CO_2Me$ (m. p. 174°), and *ethyl* ester, $C_{14}H_5O_2(OH)_2 \cdot CO_2Et$ (m. p. 159°), insoluble in cold sodium carbonate.

(2) Rhein yields a diacetate, and prolonged treatment with acetylating agents failed to introduce any further acetyl groups.

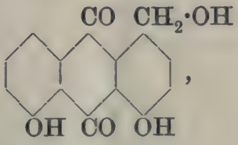
(3) Methylation of rhein with methyl sulphate and potassium hydroxide yields *dimethylrhein*, $C_{14}H_5O_2(OMe)_2 \cdot CO_2H$ (m. p. 281—282°), which is also a strong acid, readily soluble in sodium carbonate or sodium acetate, and incapable of acetylation or benzoylation. It would appear that the methylrhein (m. p. 288°) which Oesterle and Tisza (*loc. cit.*) describe is identical with this substance, and their observation that it is insoluble in potassium hydroxide may possibly be due to the fact that its potassium salt is very sparingly soluble in potassium hydroxide.

Dimethylrhein yields an *ethyl* ester, $C_{14}H_5O_2(OMe)_2 \cdot CO_2Et$ (m. p. 185—187°).

When treated with thionyl chloride, dimethylrhein yields the corresponding *chloride*, $C_{14}H_5O_2(OMe)_2 \cdot COCl$ (m. p. 190°), which on treatment with concentrated ammonia yields *dimethylrheinamide*, $C_{14}H_5O_2(OMe)_2 \cdot CO \cdot NH_2$ (m. p. 286°).

Now since aloe-emodin is a trihydroxymethylanthraquinone and yields rhein on oxidation, it follows that one of the hydroxyl groups is situated in the methyl group, and the authors are therefore of the opinion that aloe-emodin is a *dihydroxyanthraquinolcarbinol.*

The data at present available are not sufficient to prove conclusively the position of the several groups in rhein and aloe-emodin, but there is much reason to believe that rhein is *chrysazincarboxylic acid*, and that the carbonyl group occupies an α-position. The important facts on which these views are based are that barbaloin gives tetranitrochrysazin on treatment with nitric acid, and that aloe-emodin gives α-methylanthracene on distillation with zinc dust. If chrysazin is 1 : 8-dihydroxyanthraquinone, then aloe-emodin would have the constitution:



and rhein would be the corresponding acid.

The authors consider that aloetic acid, which results from the oxidation and nitration of aloin, is not tetranitroanthraquinone, but dinitrosodinitrochrysazin, and that aloechrysin, produced by the oxidation of aloin with chromic acid, is the aldehyde intermediate between the primary alcohol aloe-emodin and the carboxylic acid rhein.

75. "The constituents of Canadian hemp. Part II. Cynotoxin." (Preliminary note.) By Horace Finnemore.

The aqueous solution of the alcoholic extract of the root of commercial *Apocynum cannabinum* (*Trans.*, 1908, **92**, 1514) yields on extraction with chloroform, after removing the apocynin with ether (*loc. cit.*), a relatively small quantity of an intensely active substance, which produces symptoms identical with those caused by the drug itself.

Cynotoxin, $C_{20}H_{28}O_6$, is a well-defined, colourless substance, which crystallises in small, apparently rhombic pyramids, and melts and decomposes at about 165°. It is sparingly soluble in water and the usual organic solvents, and extremely bitter in taste. Pharmacological investigation by Mr. P. P. Laidlaw, M.B., has shown that it is an extremely potent drug of the digitalis class and that the pharmacological properties of apocynin (acetovanillone, *loc. cit.*) are negligible. The chemical and pharmacological properties of cynotoxin are still under investigation; it is already evident, however, that it is a dilactone, either of Kiliani's digitic acid, $C_{20}H_{32}O_8$ (*Ber.*, 1891, **24**, 339), or of a closely related isomeride.

ADDITIONS TO THE LIBRARY.

I.—*Donations.*

Guttmann, *Oscar.* The manufacture of explosives. Twenty years' progress. Four Cantor Lectures delivered at the Royal Society of Arts in November and December, 1908. pp. viii + 84. ill. London 1909. (*Recd.* 20/2/09.) From the Author.

Martindale, *W. Harrison,* and **Westcott,** *W. Wynn.* The extra pharmacopœia. 13th edition. pp. xl + 1164. London 1908. (*Recd.* 18/2/09.) From Dr. W. H. Martindale.

Owen, *F. A.* The dyeing and cleaning of textile fabrics. Based partly on notes of *H. C.* **Standage.** pp. vi + 253. New York 1909. (*Recd.* 29/2/09.)

From the Publishers: Messrs. John Wiley & Sons.

Schryver, *Samuel Barnett.* The general characters of the proteins. pp. x + 86. London 1909. (*Recd.* 4/3/09.)

From the Publishers: Messrs. Longmans, Green & Co.

Tschelinzeff, *W.* Individuelle magnesiumorganische Verbindungen, und ihre Umwandlungen in Oxonium- und Ammonium-Komplexe. pp. iv + 271. Moscow 1908. [In Russian.] (*Recd.* 18/2/09.)

From Dr. A. McKenzie.

II.—*By Purchase.*

Bruni, *Giuseppe.* Feste Lösungen und Isomorphismus. pp. vi + 130. Leipzig 1908. (*Recd.* 3/3/09.)

Ditmar, *Rudolf.* Die Analyse des Kautschuks, der Guttapercha, Balata und ihrer Zusätze, mit einschluss der Chemie der genannten Stoffe. pp. viii + 288. ill. Wien 1909. (*Recd.* 17/2/09.)

Friend, *J. Newton.* The theory of valency. pp. xiv + 180. London 1909. (*Recd.* 27/1/09.)

Hall, *Alfred Daniel.* The soil. 2nd edition. pp. xv + 311. ill. London 1908. (*Recd.* 20/1/09.)

Haller, *Albin.* Les récents progrès de la chimie. (Troisième série.) Conférences faites au Laboratoire de Chimie organique de la Sorbonne, sous la direction de A. Haller. pp. 261. Paris 1908. (*Recd.* 5/2/09.)

Hubert, *Paul.* Plantes à parfums. pp. xii + 610. ill. Paris 1909. (*Recd.* 17/2/09.)

Jörgensen, *S. M.* Die Entdeckung des Sauerstoffes. Aus dem Dänischen von *Vilhelm* **Ortwed** und *Max* **Speter.** (Sammlung, Vol. XIV.) Stuttgart 1909.

Schenck, *Rudolf.* Physikalische Chemie der Metalle. Sechs Vorträge über die wissenschaftlichen Grundlagen der Metallurgie. pp. vi + 193. ill. Halle a. S. 1909. (*Recd.* 17/2/09).

ANNIVERSARY DINNER.

It has been arranged that the Fellows of the Society and their riends shall dine together at the Whitehall Rooms, Hotel Metropole, t 6.30 for 7 o'clock, on Thursday, March 25th, 1909 (the day fixed or the Annual General Meeting).

The price of the tickets will be One Guinea each, including wine.

All applications for tickets must be received not later than Thursday, March 18th next.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, made payable to "Mr. S. E. Carr" and addressed to the Assistant Secretary, Chemical Society, Burlington House, W.

At the Annual General Meeting to be held on Thursday, March 25th, at 4 p.m., the PRESIDENT will deliver an address entitled: "Elements and Electrons."

At the next Ordinary Meeting, on **Thursday**, March **18th**, 1909, at 8.30 p.m., the following papers will be communicated:

"Iodine dioxide." By M. M. P. Muir.

"The constituents of the rhizome of *apocynum androraemifolium.*" By C. W. Moore.

"The action of phosphorus pentachloride on the methylene ethers of catechol derivatives. Part IV. Derivatives of dihydroxyphenylacetic, -glycollic, and -glyoxylic acids." By G. Barger and A. J. Ewins.

"Studies in the azine series. Part I. The constitution of safranine." By J. T. Hewitt, S. H. Newman, and T. F. Winmill.

"The condensation of amides with esters of acetylenic acids." By S. Ruhemann.

"A polarimetric method of identifying chitin." By J. C. Irvine.

"Studies in asymmetric synthesis. Part VII. The influence of the *d*-amyl group." By A. McKenzie and H. A. Müller.

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Issued 26/3/09

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 354.

Thursday, March 18th, 1909, at 8.30 p.m., Sir William Ramsay, K.C.B., F.R.S., President, in the Chair.

Messrs. F. P. Dunn, J. T. Furnell, J. H. Jeffery, P. May, A. B. Robertson, and W. O. Wootton were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs. :

Albert Riley Blackburn, B.Sc., Marshville, Derby Road, Widnes, Lancs.
Walter Campbell, Albert House, Westcliff-on-Sea.
Daniel Little Couch, 9, Charlmont Road, Tooting, S.W.
Edward Gordon Couzens, B.Sc., 47, Allfarthing Lane, Wandsworth.
Francis Clifford Dyche-Teague, B.Sc., 8, Mount Road, Hendon, N.W.
Charles James Grist, Apsley House, Banstead, Surrey.
Leonard Angelo Levy, B.A., B.Sc., 60, Priory Road, West Hampstead, N.W.
Robert Müller, Royal College of Science, South Kensington, S.W.
Frederick Leigh Okell, c/o Straits Trading Co., Singapore.
John Webster, 44, Holmewood Gardens, Brixton Hill, S.W.

A Certificate has been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Mr.:

Henry Ernest John Bletcher, Winnipeg, Manitoba.

The PRESIDENT announced that those Fellows desirous of supporting the International Memorial to the late Marcelin Berthelot should forward their subscriptions to M. H. Bocquillon-Limousin, 2bis Rue Blanche, Paris.

Of the following papers, those marked * were read :

*76. "Liquid and solid radium emanation."

By Robert Whytlaw Gray and Sir William Ramsay, K.C.B.

In the course of some recent work on radium emanation, the authors have prepared this gas in a state of fair purity, and it appeared worth while trying to liquefy it by pressure. It was therefore introduced into a very fine-bore capillary tube of 0·08 mm. diameter, fitted in a compression apparatus of the kind used by Ramsay and Young, and compressed to a smaller volume. When sufficiently small, there was seen at the conical point of the tube a minute column of liquid, easily visible under low microscopic power. By altering the volume, more or less liquid could be condensed. In short, by transmitted light all the usual phenomena of condensing and evaporating a liquid were observed. The liquid is colourless, and indistinguishable from water, or from, say, liquefied argon or xenon. If, however, the illumination from behind be extinguished, and the tube be viewed by its own illumination, even in broad daylight, the liquid is visible as a greenish or bluish-green phosphorescent layer, not very luminous, but more luminous than the gaseous layer. Its vapour pressures were measured at – 10° (boiling point of sulphur dioxide), 0° (melting point of ice), 12·8° and 16·2° (atmospheric temperatures), and 47° (boiling point of carbon disulphide). But the gas was not quite pure; pressure rose during condensation. Allowing approximately for this, Ramsay and Young's rule was made use of to calculate the vapour-pressure curve. The pressures and temperatures are as follows :

P.	*T.*	*P.*	*T.*
100 mm.	– 74·5°	1000 mm.	– 43·1°
200 ,,	– 66·1	2000 ,,	– 31·0
500 ,,	– 53·6	5000 ,,	– 12·8
760 ,,	– 48·5	10,000 ,,	+ 1·5

These vapour pressures must be taken as only approximate. The density of the liquid could be estimated, too, with rough approximation, as about 7, assuming that of the gaseous emanation to be 100 times that of gaseous hydrogen; it is considerably higher than that of xenon, namely, 3·52.

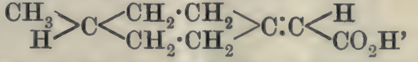
This liquid, as remarked, is only feebly phosphorescent. But if cooled by touching the tube with cotton-wool moistened with liquid air, it turns brilliant; the colour changes to a bright steel-blue, and it blazes with light. Continued application of liquid air changes the colour, first to white, then to yellow, and finally to orange. Through the microscope it looks like a brilliant little arc light. On removing the liquid air, the reverse change occurs; the orange light becomes yellow, then white, and then blue; and there seems to be some sort of disturbance in the tube, as if crystals of a solid were disintegrating; then appears the faintly phosphorescing liquid, and if the volume be large enough, the still more faintly phosphorescing gas. Transmitted light shows merely a colourless liquid, as before. These changes can be reproduced again and again; they were exhibited to several persons in the laboratory. There is no doubt that the substance which is brilliantly luminous is a solid.

In *Nature* (1909, **79**, 457), Professor Rutherford describes experiments in which he obtained such "a brilliant point of phosphorescent light"; and he measured the temperature at which the "initial condensation of the emanation" occurred at atmospheric pressure; he found it to be – 65°. In the light of the above experiments, it is difficult to say what he was observing; probably, the solidifying point of the emanation, although he speaks of having seen "small drops of liquid emanation on the walls of the capillary."

*77. "Optically active substances which contain no asymmetric atom." (Preliminary note.) By William Henry Perkin, William Jackson Pope, and Otto Wallach.

The possible existence of optically active substances which contain no asymmetric atom in the molecule was foreseen many years ago by van't Hoff, but the attempts hitherto made to obtain such compounds have been unsuccessful. All the constitutional formulæ at present assigned to substances which exhibit optical activity in the liquid state indicate the presence of one or more asymmetric atoms in the molecule.

Some time ago Perkin and Pope (Trans., 1908, **93**, 1082) synthesised 1-methyl*cyclo*hexylidene-4-acetic acid,



$$\begin{matrix}CH_3\\H\end{matrix}\!>\!C\!<\!\begin{matrix}CH_2\cdot CH_2\\CH_2\cdot CH_2\end{matrix}\!>\!C{:}C\!<\!\begin{matrix}H\\CO_2H\end{matrix},$$

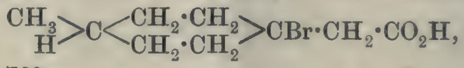
and pointed out that, on the basis of the tetrahedral environment of the carbon atom in methane, this substance possesses an enantiomorphous molecular configuration, and should hence exist in optically active forms. The constitutional formula, however, comprises no atom which can be described as asymmetric, no matter which definition of an asymmetric atom be adopted. The authors have now succeeded in separating from the synthetic and optically inactive acid a pure optically active modification of 1-methyl*cyclo*hexylidene-4-acetic acid by the method described below.

To a hot aqueous solution of two molecular proportions of externally compensated sodium 1-methyl*cyclo*hexylidene-4-acetate is added a hot aqueous solution of very slightly less than one molecular proportion of brucine hydrochloride; during admixture alcohol is added in just sufficient quantity to prevent the solution becoming turbid owing to separation of an oily salt. On cooling and scratching with a glass rod, rather less than one-half of the acid separates as crystalline *brucine* lævo-1-*methyl*cyclo*hexylidene*-4-*acetate*,

$$C_{28}H_{26}O_4N_2,C_9H_{14}O_2,2H_2O,$$

whilst most of the dextro-component of the acid remains in solution as sodium salt. After crystallisation from dilute alcohol to remove adherent mother liquor, the pure salt is obtained in colourless needles melting at 97°; it shows the specific rotatory power $[\alpha]_D - 58 \cdot 1^\circ$ in a 0·8 per cent. alcoholic solution.

lævo-1-*Methyl*cyclo*hexylidene*-4-*acetic acid* is obtained from the brucine salt by addition of hydrochloric acid to its hot aqueous solution; after crystallisation from light petroleum the optically active acid melts at 52·5°, and shows the specific rotatory power $[\alpha]_D - 81^\circ$ in alcoholic solution. On treatment with fuming hydrobromic acid it yields the potentially inactive 4-bromo-1-methyl*cyclo*hexyl-4-acetic acid,



$$\begin{matrix}CH_3\\H\end{matrix}\!>C<\!\begin{matrix}CH_2\cdot CH_2\\CH_2\cdot CH_2\end{matrix}\!>CBr\cdot CH_2\cdot CO_2H,$$

which melts at 78°.

Discussion.

Dr. Tutton asked whether Prof. Pope had been able to measure the crystals, and if so, whether he had found them to belong, as usual in cases of optical activity, to one of the eleven enantiomorphous classes which exhibit lower symmetry than the maximum symmetry of their system.

Dr. McKenzie referred to the work of Marckwald and Meth in this connexion. Reference was also made to the fact that the configurations assigned to the active inosites represent these compounds as not possessing an asymmetric atom.

Replying to Dr. Tutton, Prof. Pope stated that attempts were being made to examine derivatives of the active acid goniometrically in order to ascertain whether Pasteur's law holds in connection with the crystalline form of substances which owe their optical activity to the new kind of asymmetry now discovered. In reply to Prof. Armstrong, it was observed that although the molecule contains no asymmetric atom, an asymmetric system forms part of the molecular configuration, and that the optical activity arises from the enantiomorphism thus introduced. In connexion with Dr. McKenzie's remarks, Prof. Pope observed that no doubt can now exist that the acid described by Marckwald as 1-methyl*cyclo*hexylidene-4-acetic acid is really 1-methyl*cyclo*hexene-4-acetic acid, the molecule of which contains an asymmetric carbon atom. The configuration assigned to inosite certainly contained asymmetric carbon atoms.

*78. "The constituents of the rhizome of Apocynum androsæmifolium." By Charles Watson Moore.

The material employed in this investigation was the rhizome of *Apocynum androsaemifolium*, Linné. An alcoholic extract of the rhizome, when distilled in a current of steam, yielded small amounts of an essential oil and acetovanillone. The non-volatile constituents of the rhizome, as obtained after treating the alcoholic extract with steam, consisted of a brown resin (A) insoluble in either hot or cold water; a brown resin (B) soluble in the hot aqueous liquid, but which was slowly deposited on standing; and material which remained dissolved in the cold aqueous liquid. The brown resin (A) yielded small quantities of ipuranol, $C_{23}H_{38}O_2(OH)_2$ (m. p. 285—290°), and acetovanillone; palmitic, stearic, oleic, and linolic acids, and a large quantity of unsaponifiable material. From the latter, two new alcohols, *androsterol*, $C_{30}H_{49}\cdot OH$ (m. p. 208—210°), and *homo-androsterol*, $C_{27}H_{43}\cdot OH$ (m. p. 192°), were obtained, whilst the presence of a third alcohol was proved by the isolation of its *bromoacetyl* derivative (m. p. 265—268°). Androsterol yields an *acetyl* derivative (m. p. 212—214°) and a *monobromoacetyl* derivative (m. p. 228—230°). *Acetylhomoandrosterol* melts at 236°. The brown resin (B) yielded a further small quantity of acetovanillone. The portion of the alcoholic extract of the rhizome which was soluble in cold water, and from which the above-described resins had been removed, contained large amounts of sugar and tannin. It yielded a quantity of acetovanillone (m. p. 115), which was also present in the form of its glucoside, *androsin*, $CH_3\cdot CO\cdot C_6H_3(O\cdot CH_3)\cdot O\cdot C_6H_{11}O_5,2H_2O$ (m. p. 218—220°), and a new substance, *apocynamarin*, $C_{28}H_{36}O_6,2H_2O$ (m. p. 170—175°), which possesses an intensely bitter taste, is highly toxic, and represents the chief active constituent of the rhizome.

*79. "The action of phosphorus pentachloride on the methylene ethers of catechol derivatives. Part IV. Derivatives of dihydroxyphenyl-acetic, -glycollic, and -glyoxylic acids." By George Barger and Arthur James Ewins.

Starting from ethyl 3:4-methylenedioxymandelate, which is more readily obtained from piperonalcyanohydrin than the corresponding acid (previously obtained by Lorenz, *Ber.*, 1881, **14**, 793), the authors have prepared a number of methylene ethers and cyclic carbonates related to 3:4-dihydroxymandelic acid, $C_6H_3(OH)_2 \cdot CH(OH) \cdot CO_2H$, and to 3:4-dihydroxyphenylglyoxylic acid, $C_6H_3(OH)_2 \cdot CO \cdot CO_2H$, and also these acids themselves.

3:4-Dihydroxymandelic acid and its derivatives are very soluble in water, quite unlike epinephrine (adrenaline), which also contains the complex $C_6H_3(OH)_2 \cdot CH(OH) \cdot$. Dihydroxymandelic acid is much less stable than the corresponding keto-acid.

*80. "Studies in the azine series. Part I. The constitution of safranine." By John Theodore Hewitt, Sidney Herbert Newman, and Thomas Field Winmill.

Phenosafranine has the composition of a salt (chloride) of phenylphenazonium. According to Bernthsen the two amino-groups are symmetrically situated, whilst Witt supposed that one was in the phenyl group, only one being attached to the phenazine nucleus. The question was apparently decided in favour of Bernthsen's formula by Körner and Schraube, who obtained identical dialkylsafranines by the oxidation of (*a*) one molecule of *as*-dialkyl-*p*-phenylenediamine with two molecules of aniline, and (*b*) one molecule each of *p*-phenylenediamine, aniline, and its dialkyl derivative.

More recently P. Barbier and P. Sisley (*Ann. Chim. Phys.*, 1908, [viii], **13**, 96) have stated that phenosafranine, as prepared by oxidising *p*-phenylenediamine with aniline, consists essentially of the asymmetric compound mixed with small amounts of an isomeride having the structure given by Bernthsen.

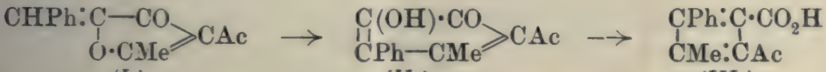
The present authors find that the hydroxyaposafranone obtained from safranine is identical with that prepared by Jaubert's method from nitrosophenol and *m*-hydroxydiphenylamine (*Ber.*, 1895, **28**, 273), since the acetyl derivatives prepared from both specimens melt at 271° (uncorr.) whether alone or mixed (Fischer and Hepp give 265—268°: *Ber.*, 1897, **30**, 401).

The synthesis of an asymmetric phenosafranine by oxidation of aniline with 2 : 4′-diaminodiphenylamine described by Barbier and Sisley (*loc. cit.*, p. 102) could not be realised, any safranine obtained by them probably owing its origin to admixed 4 : 4′-diaminodiphenylamine, since potassium dichromate converts 2 : 4′-diaminodiphenylamine into aminophenazine whether aniline be present or not.

The experiments recorded are only compatible with the symmetrical (Bernthsen's) formula for phenosafranine.

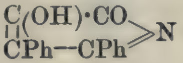
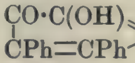
*81. "The condensation of amides with esters of acetylenic acids." By Siegfried Ruhemann.

Ruhemann and Merriman (Trans., 1905, **87**, 1383) have shown that acetylacetone condenses with phenylpropiolyl chloride to a yellow furfuran derivative (I); this readily changes into its red isomeride (II), which, with bases, forms blue salts, and with hot sodium carbonate yields a colourless acid (III) isomeric with (I) and (II). These changes were represented thus:



$$\begin{array}{l}\text{CHPh:C—CO}\\ \quad\text{O·CMe}\end{array}\!\!>\text{CAc} \longrightarrow \begin{array}{l}\text{C(OH)·CO}\\ \text{CPh—CMe}\end{array}\!\!>\text{CAc} \longrightarrow \begin{array}{l}\text{CPh:C·CO}_2\text{H}\\ \text{CMe:CAc}\end{array}$$

(I.) (II.) (III.)

The correctness of these formulæ follows from the fact that ethyl phenylpropiolate condenses with sodiobenzamide to a coloured compound, $C_{16}H_{11}O_2N$ (dark red needles, m. p. 184°), which, with alkalis, forms blue salts; the substance which is to be regarded as *diphenyldiketopyrroline*,  $\begin{array}{l}\text{C(OH)·CO}\\ \text{CPh—CPh}\end{array}\!\!>\text{N}$ or  $\begin{array}{l}\text{CO·C(OH)}\\ \text{CPh=CPh}\end{array}\!\!>\text{N}$, shows in its properties and structure a striking resemblance both to the compound (II) and the similarly constituted substances (see Ruhemann and Merriman, *loc. cit.*) and to isatin. On boiling with potassium hydroxide, it decomposes quantitatively into ammonia, oxalic acid, and deoxybenzoin.

Discussion.

Dr. Hewitt fully agreed with Dr. Ruhemann that in the compounds he described the sodium probably attached itself to an oxygen atom. He ventured to suggest this might be equally well expressed by a rearrangement of the conjugate double linkings as by the formation of a bridged ring.

*82. "Studies in asymmetric synthesis. Part VII. The influence of the *d*-amyl group." By Alex. McKenzie and Hermann August Müller.

The action of magnesium organic compounds on *d*-amyl pyruvate and *d*-amyl benzoylformate respectively has been examined. The asymmetric synthesis of *d*-lactic acid by the reduction of *d*-amyl pyruvate was described.

It appears that the more optically active is the directing asymmetric agent the more pronounced is the asymmetric synthesis.

Attempts to substitute gallic acid for 3-nitrophthalic acid in order to effect the separation of *d*-amyl alcohol from fusel oil were not successful.

*83. "Contributions to the chemistry of cholesterol and coprosterol." By Charles Dorée.

The author has investigated the action of ozone on the following cholesterol derivatives: cholestenone, the acid $C_{27}H_{44}O_4$, β-cholestanol, coprosterol, ψ-coprosterol, and the ketones corresponding with these and α-cholestanol. All of these with the exception of α-cholestanol, which is indifferent, react with ozone, and the determination of the ozone numbers of these compounds confirms generally the view of Molinari (*Ber.*, 1908, **41**, 2782) that a second double linking is present in the cholesterol molecule. For this there is no other chemical evidence, and the addition of the second molecule of ozone has now been shown to take place with considerable difficulty, so that this may not be a case of simple addition, but of a development of some grouping in the molecule under the influence of ozone with subsequent addition.

Reasons were given for ascribing to the compound previously obtained by the action of phenylhydrazine on coprostanone (*Trans.*, 1908, **93**, 1627) a constitution of the carbazole type. A crystalline *nitrosite* was prepared and analysed.

84. "Iodine dioxide." By Matthew Moncrieff Pattison Muir.

Reference was made to the work of Millon, in 1844, and of Kämmerer, in 1861, on an oxide of iodine said to be composed of iodine and oxygen united in the ratio of I : 2O, none of which work satisfactorily proved the existence of the compound.

The compound IO_2, or I_2O_4, has been prepared by the dehydration and partial deoxidation of iodic acid by heating that acid with concentrated sulphuric acid. Two methods of analysing iodine dioxide were described. It was shown that the interactions of this oxide and oxalic acid, in the presence of sulphuric acid, at 100°, and with boiling water, are severally represented by the equations:

$$(1)\ I_2O_4 + 4C_2H_2O_4 = I_2 + 4H_2O + 8CO_2$$

and

$$(2)\ 5I_2O_4 + 4H_2O = 8HIO_3 + I_2.$$

Iodine dioxide is a pale yellow, crystalline solid of specific gravity 4·2; it is decomposed at about 130° into iodine and oxygen. The molecular weight of the compound has not been determined. The reactions of the oxide with acids and with various reagents were described; in most of these interactions, iodine pentoxide and iodine are produced. Iodine dioxide is slightly soluble in cold concentrated sulphuric acid; 100 c.c. of the acid dissolve 1·54 grams of the oxide at 15° to 20°. Inasmuch as iodine dioxide forms a compound with sulphur trioxide having the composition $I_2O_4,3SO_3$, the oxide has slightly basic properties. This compound is not decomposed by heating to 100°, but begins to give off iodine, oxygen, and sulphur trioxide at about 120°.

Incidentally, it was shown that iodic anhydride and sulphur trioxide combine, when heated together at 100°, to form a compound which has the composition $I_2O_5,2SO_3$.

The slightly basic characters of the two oxides of iodine emphasise the connexions between iodine and manganese.

85. "A polarimetric method of identifying chitin."

By James Colquhoun Irvine.

A solution of chitin in concentrated hydrochloric acid is slowly transformed into glucosamine hydrochloride at the ordinary temperature. The change is greatly accelerated by keeping the solution at 45°, being then complete in eight to ten hours. Under these conditions, the hydrolysis is quantitative, no humic compounds or other colouring matters are produced, and thus the reaction may be followed polarimetrically. As chitin is lævorotatory, the conversion into glucosamine hydrochloride is accompanied by a characteristic "inversion," the average result (calculated on the initial concentration) being:

$$[\alpha]_D^{20}\ -14{\cdot}1^\circ \longrightarrow [\alpha]_D^{20}\ +56{\cdot}0^\circ.$$

The results obtained showed great uniformity, and thus the method can be applied as a test for chitin, which is capable of positively identifying 0·1 gram of the substance.

The constancy of rotatory power observed with specimens of chitin prepared from widely different sources affords strong evidence that the substance is a definite compound of uniform composition and structure. As “spongin” and “keratin” did not show any optical inversion during hydrolysis, it seems doubtful if these substances are in any way related to chitin. The different formulæ suggested for the latter compound have been examined in their relationship to the polarimetric results, the best agreement being given by the expression $(C_{30}H_{50}O_{19}N_4)_n$, in which aminoglucose and acetylaminoglucose residues are present in the proportion of one to three.

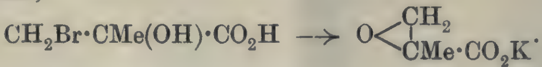
86. “The conversion of *d*-*a*-methyl*iso*serine into *d*-*a*-methylglyceric acid.” By Francis William Kay.

In the course of investigating the action of nitrosyl bromide on the *β*-amino-acids, it was found that *a*-methyl*iso*serine (*β*-amino-*a*-hydroxy*iso*butyric acid) was converted into *β*-bromo-*a*-methyl-lactic acid (*β*-bromo-*a*-hydroxy*iso*butyric acid), which melts at 102—103° (uncorr.), and has already been described by Melikoff (*Annalen*, 1886, **234**, 213):

$$\mathrm{NH_2{\cdot}CH_2{\cdot}CMe(OH){\cdot}CO_2H \xrightarrow{NOBr} CH_2Br{\cdot}CMe(OH){\cdot}CO_2H.}$$

d-*a*-Methyl*iso*serine by a similar treatment yields d-*β-bromo-a-methyl-lactic acid*, which crystallises from benzene in needles, m. p. 114° (uncorr.), and has $[a]_D^{20} + 7{\cdot}40°$ in approximately 10 per cent. aqueous solution.

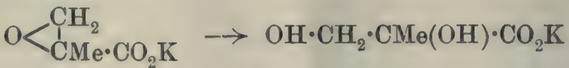
The action of the theoretical amount of alcoholic potassium hydroxide (2 mols.) converts the above bromo-acid into *potassium* d-*a-methylglycidate*,



$$\mathrm{CH_2Br{\cdot}CMe(OH){\cdot}CO_2H \longrightarrow O{<}\begin{array}{l}CH_2\\ \ |\\ CMe{\cdot}CO_2K\end{array}}$$

This salt crystallises in silvery leaflets, and has $[a]_D^{20}\ -17{\cdot}57°$.

When potassium *d*-*a*-methylglycidate is heated with water to 100°, it undergoes hydroxylation and is transformed into *potassium* d-*a-methylglycerate*:



$$\mathrm{O{<}\begin{array}{l}CH_2\\ \ |\\ CMe{\cdot}CO_2K\end{array} \longrightarrow OH{\cdot}CH_2{\cdot}CMe(OH){\cdot}CO_2K}$$

The aqueous solution of this salt has a specific rotation of $-4{\cdot}00°$.

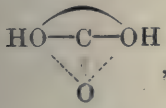
87. “The action of steam on iron.” (Preliminary note.) By John Albert Newton Friend.

The author has studied the action of steam on iron at temperatures ranging from 100° to a red heat. It is found that pure, carbon dioxide-free steam has no action on pure iron until those temperatures are reached at which the steam begins to dissociate, when a black oxide (presumably Fe_3O_4) is produced.

The conclusion is drawn that the usual statement that steam is decomposed by red-hot iron is not true. The reaction really takes place in two stages, involving (i) the dissociation of the steam, and (ii) combination of the iron with the dissociated oxygen.

88. "The constitution of sulphurous, sulphuric, carbonic, and formic acids." By John Albert Newton Friend.

In a recent communication, Miss Smedley (*Trans.*, 1909, **95**, 231) has discussed the constitution of the carboxyl group, and incidentally suggests that carbonic, sulphurous, and sulphuric acids may be represented by the schemes :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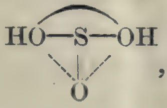
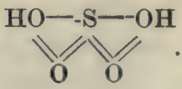
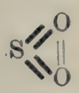
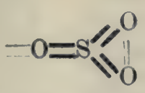
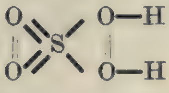

, and

.

The instability of the first two acids is attributed to the symmetrical arrangement of the third atom of oxygen between two hydroxyl groups.

The present author considers, however, that such an explanation is not sufficient. Arguing along similar lines it would be expected that an acid containing a fourth atom of oxygen between *three* hydroxyl groups would be too unstable to exist, but orthophosphoric acid, $PO(OH)_3$, is comparatively very stable. Evidence has already been adduced (Friend, *Trans.*, 1908, **93**, 266) to show that the molecules of sulphur di- and tri-oxides are most probably correctly represented by the schemes :

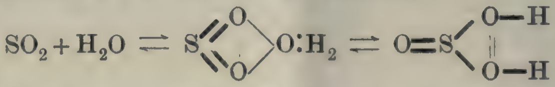

and

,

where the thick lines represent the free valencies, and the thin, the latent valencies. Since the latent valencies of the third oxygen atom in the trioxide are unsaturated, the latter readily combines with water to form a stable hydrate, which then undergoes more or less complete rearrangement to sulphuric acid until equilibrium is attained :

$$SO_3 + H_2O \rightleftharpoons O_2\vdots S\vdots O{:}O\vdots H_2 \rightleftharpoons$$

.

Since the hydrate is exceedingly stable, there is little tendency for the reactions to proceed from right to left; hence the stability of the sulphuric acid.

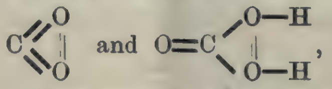
With sulphur dioxide, however, the case is different. The latent valencies of the two oxygen atoms mutually saturate each other, and there is little tendency for a hydrate to form; hence equilibrium is obtained according to the following schemes:



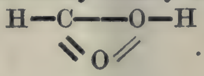
when only a small quantity of the hydrate is present, and the relative concentration of the sulphurous acid can therefore never be great. This would account for the instability of the acid, and the fact that its solution exhibits all the properties of the dioxide. It might appear at first sight that, since sulphur dioxide is unsaturated, a hydrate of the type

$$H_2O{=}{=}SO_2$$

might be formed. This is, however, not possible, as the free valencies of the sulphur are positive, whereas one of the latent valencies of the oxygen is positive and the other negative (Friend, *loc. cit.*). Carbon dioxide and carbonic acid may be represented by the schemes:



and a similar explanation for the instability of the acid holds. In formic acid a carboxylic group is present, and the latent valencies of the two oxygen atoms mutually satisfy each other, thus:

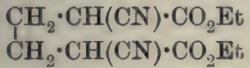


That carbon monoxide does not dissolve in water to form formic acid is explained by the fact that the free and latent valencies of the oxygen atom saturate the four free valencies of the carbon atom, a saturation which is rendered possible by the amphoteric nature of the latter (Friend, *loc. cit.*); hence it is not until some vigorous method is adopted for breaking this connexion, as, for example, the action of the gas on heated potassium hydroxide, that formic acid can be prepared.

89. "The formation and reactions of imino-compounds. Part IX. The formation of derivatives of *cyclo*pentane from $\alpha\delta$-dicyano-derivatives of butane." By Stanley Robert Best and Jocelyn Field Thorpe.

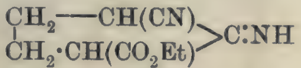
When ethylene dibromide reacts with dry ethyl sodiocyanoacetate (compare this vol., p. 17) in benzene solution, ethyl $\alpha\delta$-dicyanoadipate

(I) is formed, and this compound is readily transformed into ethyl carbonate and *ethyl* 2-*imino*-3-*cyano*cyclo*pentane*-1-*carboxylate* (II), from which 1-*imino*-2-*cyano*cyclo*pentane* (III) can be easily obtained.



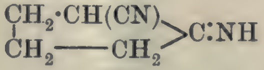
$$\begin{array}{l} CH_2\cdot CH(CN)\cdot CO_2Et \\ | \\ CH_2\cdot CH(CN)\cdot CO_2Et \end{array}$$

(I.)



$$\left.\begin{array}{l} CH_2 — CH(CN) \\ | \\ CH_2\cdot CH(CO_2Et) \end{array}\right> C{:}NH$$

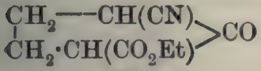
(II.)



$$\left.\begin{array}{l} CH_2\cdot CH(CN) \\ | \\ CH_2 —— CH_2 \end{array}\right> C{:}NH$$

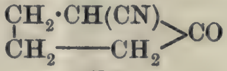
(III.)

These imino-compounds are hydrolysed by cold mineral acids, yielding *ethyl* 5-*cyano*cyclo*pentan*-1-*one*-2-*carboxylate* (IV) and 2-*cyano*cyclo*pentan*-1-*one* (V) respectively, whilst further treatment with acids yields, in both cases, *cyclo*pentanone (VI).



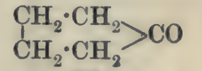
$$\left.\begin{array}{l} CH_2 — CH(CN) \\ | \\ CH_2\cdot CH(CO_2Et) \end{array}\right> CO$$

(IV.)



$$\left.\begin{array}{l} CH_2\cdot CH(CN) \\ | \\ CH_2 —— CH_2 \end{array}\right> CO$$

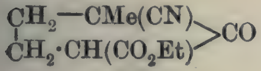
(V.)



$$\left.\begin{array}{l} CH_2\cdot CH_2 \\ | \\ CH_2\cdot CH_2 \end{array}\right> CO$$

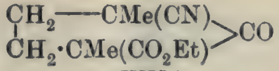
(VI.)

The methylation of ethyl 5-cyano*cyclo*pentan-1-one-2-carboxylate (IV) leads to the formation of *ethyl* 5-*cyano*-5-*methyl*cyclo*pentan*-1-*one*-2-*carboxylate* (VII) and *ethyl* 5-*cyano*-2 : 5-*dimethyl*cyclo*pentan*-1-*one*-2-*carboxylate* (VIII); the first-named compound, on hydrolysis, is transformed into 2-*cyano*-2-*methyl*cyclo*pentan*-1-*one* (IX), which is identical with the compound prepared by the methylation of 2-cyano*cyclo*pentan-1-one (V).



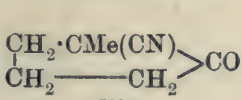
$$\left.\begin{array}{l} CH_2 — CMe(CN) \\ | \\ CH_2\cdot CH(CO_2Et) \end{array}\right> CO$$

(VII.)



$$\left.\begin{array}{l} CH_2 —— CMe(CN) \\ | \\ CH_2\cdot CMe(CO_2Et) \end{array}\right> CO$$

(VIII.)

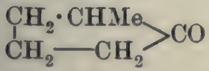


$$\left.\begin{array}{l} CH_2\cdot CMe(CN) \\ | \\ CH_2 —— CH_2 \end{array}\right> CO$$

(IX.)

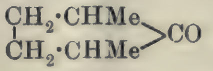
The ethylation of ethyl 5-cyano*cyclo*pentan-1-one-2-carboxylate (II) yields a mixture consisting of four parts of the *O*-ethyl derivative and one part of the *C*-ethyl derivative.

The *cyclo*pentane ring in these compounds is stable towards acid hydrolysing agents, and therefore 2-*methyl*cyclo*pentan*-1-*one* (X), 2 : 5-*dimethyl*cyclo*pentan*-1-*one* (XI), and 2-*ethyl*cyclo*pentan*-1-*one* (XII) can be readily obtained from the compounds mentioned above.



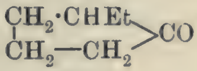
$$\left.\begin{array}{l} CH_2\cdot CHMe \\ | \\ CH_2 — CH_2 \end{array}\right> CO$$

(X.)



$$\left.\begin{array}{l} CH_2\cdot CHMe \\ | \\ CH_2\cdot CHMe \end{array}\right> CO$$

(XI.)

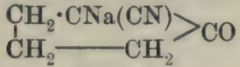


$$\left.\begin{array}{l} CH_2\cdot CHEt \\ | \\ CH_2 — CH_2 \end{array}\right> CO$$

(XII.)

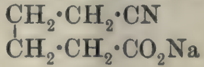
The ring is, however, readily broken by the action of alkalis, the final product in every case being either adipic acid or an alkyl derivative.

Probably the most remarkable instance of the instability of the *cyclo*pentane ring under these conditions is afforded by the sodium derivative of 5-*cyanocyclopentan-1-one* (XIII), which dissolves in water, forming the sodium salt of δ-cyanovaleric acid (XIV), from which adipic acid (XV) can be obtained on further hydrolysis.



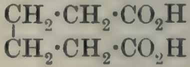
$$\begin{array}{l}CH_2\cdot CNa(CN)\\ CH_2\text{——}CH_2\end{array}\!\!>CO$$

(XIII.)



$$\begin{array}{l}CH_2\cdot CH_2\cdot CN\\ CH_2\cdot CH_2\cdot CO_2Na\end{array}$$

(XIV.)

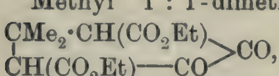


$$\begin{array}{l}CH_2\cdot CH_2\cdot CO_2H\\ CH_2\cdot CH_2\cdot CO_2H\end{array}$$

(XV.)

90. "The preparation of methyl 1 : 1-dimethyl*cyclo*pentan-3 : 4-dione-2 : 5-dicarboxylate." By Jocelyn Field Thorpe.

Methyl 1 : 1-dimethyl*cyclo*pentan-3 : 4-dione-2 : 5-dicarboxylate,



$$\begin{array}{l}CMe_2\cdot CH(CO_2Et)\\ CH(CO_2Et)\text{—}CO\end{array}\!\!>CO$$

was first prepared and identified by Dieckmann (*Ber.*, 1899, **32**, 1934), the method used for its preparation being the interaction of ethyl oxalate and methyl $\beta\beta$-dimethylglutarate in the presence of sodium ethoxide. Dieckmann prepared this substance with the expressed object (*loc. cit.*, p. 1935) of ultimately obtaining from it by reduction and by methylation and reduction acids of the same formulæ as those proposed by Bredt for camphoric acid and apocamphoric acid, but he remarks (*loc. cit.*, p. 1933) that the yield of the dimethyl salt is exceedingly small.

Dieckmann was evidently unable to overcome the initial difficulties occasioned by this poor yield, as the syntheses proposed by him were ultimately accomplished by Komppa (*Ber.*, 1901, **34**, 2472; 1903, **36**, 4332).

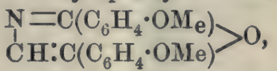
In the first of these papers (*Ber.*, 1901, **34**, 2473), Komppa stated that he had succeeded in obtaining an "almost quantitative yield" of methyl-1 : 1-dimethyl*cyclo*pentan-3 : 4-dione-2 : 5-dicarboxylate from ethyl oxalate and methyl $\beta\beta$-dimethylglutarate. He omitted to mention, however, either in his paper on apocamphoric acid or on camphoric acid, the conditions under which this increased yield could be obtained.

During the past two years the author has made numerous experiments with the object of reproducing the conditions employed by Komppa, because it was desired to prepare a quantity of this methyl salt for the purposes of another investigation, but in no one of these experiments has the yield exceeded 10 per cent. of the theory.

In view of this difficulty, and of the fact that private communications with Professor Komppa have been unsuccessful in obtaining the details of this important preparation, the author suggests that, as eight years have now elapsed since the publication of Komppa's paper on apocamphoric acid, and six years since he published his preliminary paper on the synthesis of camphoric acid, publication of the full experimental details is highly desirable.

91. "Condensations of cyanohydrins. Part I. Condensation products from anisaldehydecyanohydrin and cinnamaldehydecyanohydrin." By Hamilton McCombie and Ethel Parry.

Minovici (*Ber.*, 1899, **32**, 2206) described the action of dehydrating agents on anisaldehydecyanohydrin as resulting in the production of a compound melting at 146°, to which he assigned the formula $CH_3{\cdot}O{\cdot}C_6H_4{\cdot}CH(CN){\cdot}CO{\cdot}C_6H_4{\cdot}O{\cdot}CH_3$. This substance has now been shown to be 2 : 5-di-*p*-methoxydiphenyloxazole,



$$\left.\begin{matrix}\mathrm{N{=}C(C_6H_4{\cdot}OMe)}\\ \mathrm{CH{:}C(C_6H_4{\cdot}OMe)}\end{matrix}\right>\mathrm{O},$$

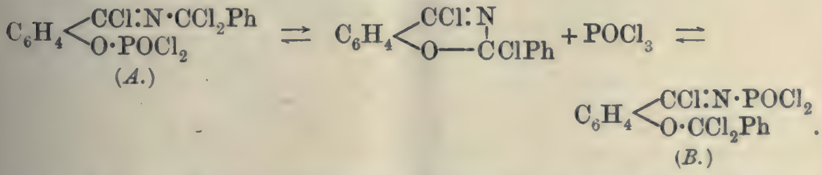
which was originally described by Minovici himself (*Ber.*, 1896, **29**, 2100), and its formation in this reaction is due to the presence of unchanged aldehyde in the cyanohydrin.

When pure anisaldehydecyanohydrin is subjected to the action of gaseous hydrogen chloride, two substances are formed, namely: (1) a compound melting at 156°, the constitution of which is to be more fully investigated, and (2) 3-*keto*-2 : 5-*di*-p-*methoxydiphenyl*-3 : 4-*dihydro*-1 : 4-*diazine*, $N\left<\begin{matrix}\mathrm{C(C_6H_4{\cdot}OMe){\cdot}CO}\\ \mathrm{CH{:}C(C_6H_4{\cdot}OMe)}\end{matrix}\right>NH$ (compare Japp and Knox, Trans., 1905, **87**, 701).

Cinnamaldehydecyanohydrin, on being subjected to the action of gaseous hydrogen chloride, yields 3-*keto*-2 : 5-*distyryl*-3 : 4-*dihydro*-1 : 4-*diazine*.

92. "Labile isomerism among the acylsalicylamide, acylhydroxyamine, and phenylbenzometoxazine groups." By Arthur Walsh Titherley and William Longton Hicks.

In order to throw fresh light on the mechanism underlying the wandering of acyl groups in derivatives of salicylamide and aromatic *o*-hydroxyamines, the behaviour of phenylbenzometoxazone with phosphorus pentachloride has been studied; and evidence has been obtained that the resulting 2 : 4-dichlorophenylbenzometoxazine under the influence of phosphoryl chloride exhibits tautomeric behaviour owing to wandering of chlorine atoms, thus:

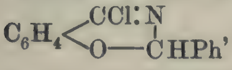


$$C_6H_4\left<\begin{matrix}CCl{:}N{\cdot}CCl_2Ph\\ O{\cdot}POCl_2\end{matrix}\right. \rightleftharpoons C_6H_4\left<\begin{matrix}CCl{:}N\\ O{-}CClPh\end{matrix}\right. + POCl_3 \rightleftharpoons C_6H_4\left<\begin{matrix}CCl{:}N{\cdot}POCl_2\\ O{\cdot}CCl_2Ph\end{matrix}\right..$$

(*A.*) (*B.*)

A bright yellow, crystalline substance is obtained which is decomposed by water, yielding benzoylsalicylonitrile, but by 98 per cent.

sulphuric acid yielding *N*-benzoylsalicylamide. As the same yellow solid is produced by the action of phosphorus pentachloride on benzoylsalicylonitrile, it must be regarded either as a mixture of *A* and *B*, or one of these in a labile form.

In the production of the yellow substance from phenylbenzometoxazone, various by-products are obtained, among which the double compound of phosphoryl chloride and 4-chlorophenylbenzometoxazine,  $C_6H_4<\begin{matrix}CCl:N\\ O—CHPh\end{matrix}$, appears to be present. Benzylidene chloride is also produced in considerable quantity together with chlorophosphorus derivatives of salicylonitrile.

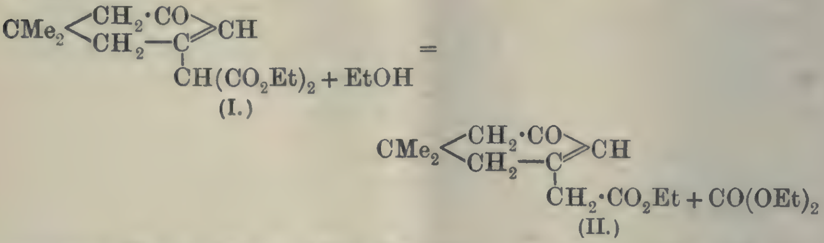
93. "The alkyl compounds of platinum."

By William Jackson Pope and Stanley John Peachey.

The authors have continued the investigation of the salts derived from trimethylplatinic hydroxide, $(CH_3)_3Pt\cdot OH$, concerning which they have already published a preliminary note (*Proc.*, 1907, **23**, 86).

94. "Note on the preparation of trimethyl*cyclo*hexenone (*iso*phorone) from ethyl malonate and chlorodimethyl*cyclo*hexenone." By Arthur William Crossley and Charles Gilling.

In a recent communication (*Trans.*, 1909, **95**, 20) it has been shown that when the sodium compound of ethyl malonate acts on 5-chloro-1 : 1-dimethyl-Δ^4-*cyclo*hexen-3-one, the condensation product does not consist of the substance having formula I, as might have been expected, but of ethyl 1 : 1-dimethyl-Δ^4-*cyclo*hexen-3-one-5-acetate (II). The formation of this latter compound necessitates the elimination of a carbethoxy-group, and it has now been proved that the reaction affords another instance of the production of ethyl carbonate during such condensations:



$$CMe_2<\begin{matrix}CH_2\cdot CO\\ CH_2—\underset{\textstyle CH(CO_2Et)_2}{C}\end{matrix}>CH + EtOH =$$

(I.)

$$CMe_2<\begin{matrix}CH_2\cdot CO\\ CH_2—\underset{\textstyle CH_2\cdot CO_2Et}{C}\end{matrix}>CH + CO(OEt)_2$$

(II.)

(compare Thorpe, *Trans.*, 1905, **87**, 1681; also *Proc.*, 1909, **25**, 17; Leuchs and Geserick, *Ber.*, 1908, **41**, 4171).

Twenty-four grams of chlorodimethyl*cyclo*hexenone were treated with ethyl malonate as already described (*loc. cit.*, p. 23). The steam distillate was extracted with ether, the ethereal solution dried, evaporated, and the residual 28 grams of liquid fractionally distilled, using a colonna. After three distillations, 7·5 grams of a liquid with an ethereal odour were obtained, boiling constantly at 126°, and giving the following numbers on analysis:

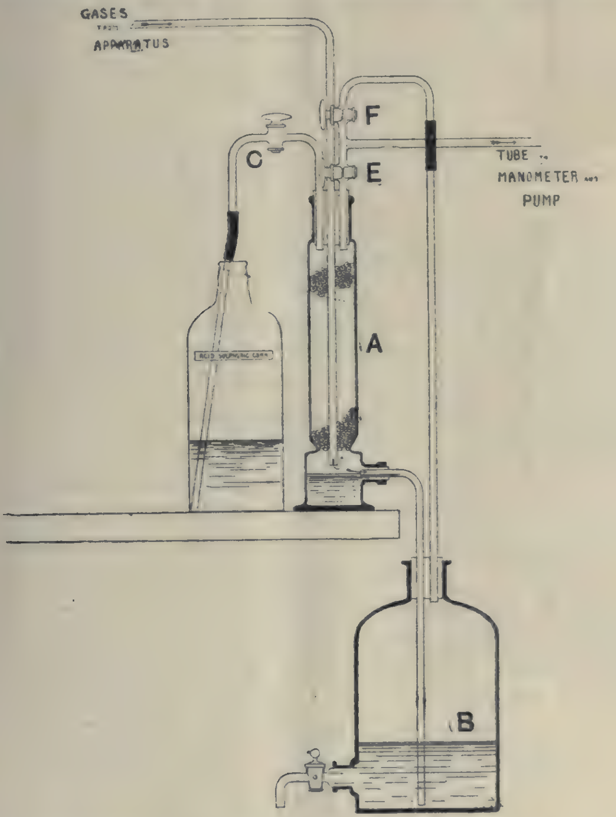
0·1927 gave 0·3575 CO_2 and 0·1471 H_2O. C = 50·59; H = 8·48.

$C_5H_{10}O_3$ requires C = 50·84; H = 8·47 per cent.

These data prove the substance to be ethyl carbonate.

95. "A simple gas-drying apparatus for use with a mechanical exhaust pump." By George Stanley Walpole.

It is found convenient in chemical laboratories to use a mechanical exhaust pump for many purposes, especially in conjunction with distillation apparatus. To maintain the pump in such a condition that at any moment it is capable of working at its maximum efficiency, it must be kept dry by use of either a steam-jacket or else an efficient drying apparatus interposed between it and the still.



The accompanying drawing represents a form of desiccator which has been in use continuously for some months under somewhat severe conditions.

The gases from the still pass directly down the tower *A*. If the tap *E* be closed and *F* open, they pass through the concentrated sulphuric acid in the reservoir *B*. This is the arrangement when the still is being exhausted at the commencement of distillation or when only a moderate vacuum is required. If the tap *F* is closed and *E* opened, the gases pass up the tower, meeting a slow stream of sulphuric acid running over the glass beads and regulated by tap *C*.

In this arrangement a short circuit is thus established which eliminates the hydrostatic pressure of the sulphuric acid in the bottle *B*, and there is no resistance offered to the gases passing to the pump. It is advisable to leave all taps turned off when the apparatus is not in use. The acid from *B* can be run out periodically, and if suitable, used again.

96. "Some esters of antimony trioxide."

By John Francis MacKey.

Lang, MacKey, and Gortner (*Trans.*, 1908, **93**, 1364) described a new method for the esterification of arsenious oxide with the aliphatic alcohols and with phenol and its homologues, and expressed the opinion that similar esters might be obtained from antimony trioxide and the same alcohols and phenols. In the present work attempts have been made to form these esters by treating a mixture of antimony trioxide and the alcohol or phenol in the following ways: (1) heating under a reflux condenser; (2) heating with Soxhlet attachment and anhydrous copper sulphate; (3) heating in sealed tubes at 150°; (4) heating with metallic calcium; (5) treating with anhydrous copper sulphate in the cold. By the second method, yields of from 3 per cent. in the case of ethyl antimonite to 15 per cent. in the case of *iso*butyl antimonite, and of 40 per cent. in the case of phenyl antimonite to 48 per cent. in the case of *m*-tolyl antimonite, were obtained. By heating with metallic calcium a yield of 60 per cent. was obtained with phenyl antimonite. The following esters were isolated in quantity: *methyl*, *ethyl*, *propyl*, iso*butyl*, *amyl*, iso*amyl*, *phenyl* o-, m- and p-*tolyl antimonites*. The aliphatic esters are all liquids, which decompose on heating at atmospheric pressure into antimony trioxide and the alcohol from which they were prepared, whilst phenyl, *o*-tolyl, and *p*-tolyl antimonites are solids melting at 13°, 16°, and 14° respectively. The boiling points of these esters, under 30 mm. pressure, are as follows: methyl, 65°; ethyl, 115—120°; propyl, 143°; *iso*butyl, 144°;

amyl, 170°; *iso*amyl, 163°; phenyl, 250°; *o*-tolyl, 352°; *m*-tolyl, 300°; and *p*-tolyl, 345°. They are soluble in absolute alcohol, ether, chloroform, or benzene, but decompose immediately on the addition of water into antimony trioxide and the alcohol from which they were prepared. Accurate methods of analysis have been worked out for both the esters of the aliphatic alcohols and the esters of phenol and its homologues. On analysis these esters were found to correspond with the general formula R_3SbO_3.

ADDITIONS TO THE LIBRARY.

THE FOLLOWING BOOKS HAVE BEEN PRESENTED TO THE LIBRARY BY Mr. EDWARD DAVIES.

Boyle, *Robert*. Opera varia, quorum posthac exstat catalogus. Cum indicibus necessariis, multisque figuris æneis. Genevæ 1680. 12 parts. (2 copies, 1 wanting portrait.)

—— Experimentorum novorum physico-mechanicorum continuatio secunda, *etc.* pp. viii + 132. ill. Genevæ 1682. (2 copies.)

—— Apparatus ad historiam naturalem sanguinis humani, ac spiritus præcipue ejusdem liquoris. pp. viii + 47. Genevæ 1686.

—— Observationes de Salsedine Maris. pp. 23. Genevæ 1686.

—— Tentamen porologicum sive ad porositatem corporum tum animalium, tum solidorum detegendam. pp. vi + 46. Genevæ 1686.

—— De specificorum remediorum cum corpusculari philosophia concordia, *etc.* pp. viii + 64. Genevæ 1687.

—— Tractatus de ipsa natura, *etc.* pp. xvi + 111. Genevæ 1688.

—— Origo formarum et qualitatum juxta philosophiam corpuscularem, *etc.* pp. xxxii + 147. Genevæ 1688.

—— Noctiluca aeria sive nova qúædam phænomena in substantiæ factitiæ sive artificialis, Sponte Lucidæ, productione observata, *etc.* pp. 108. Genevæ 1693.

—— Summa veneratio Deo ab humano intellectu debita, *etc.* pp. 43. Genevæ 1693.

—— Medicina hydrostatica, sive hydrostatica materiæ medicæ applicata, *etc.* pp. xii + 70. Coloniæ Allobrogum 1693.

—— De amore seraphico seu de quibusdam ad Dei amorem stimulis pp. viii + 59. Genevæ 1693.

—— Experimenta nec non observationes circa variarum particularium qualitatum originem, sive productionem mechanicam: Quibus accesserunt tractatus quo imperfecta chymistarum doctrina de qualitatibus detegitur, & quædam in hypothesin de alcali & acido animadversiones. pp. xvi + 144. Genevæ 1694.

—— Exercitationes circa utilitatem philosophiæ naturalis experimentalis, *etc.* pp. xvi + 602. Genevæ 1694.

—— Novorum experimentorum physico-mechanicorum continuatio prima, *etc.* pp. xii + 123. ill. Genevæ 1694.

—— Experimenta et notæ circa producibilitatem chymicorum principiorum: Quæ sunt totidem partes appendicis ad Scepticum Chymicum. pp. xii + 92. Genevæ 1694.

—— Examen dialogi physici domini T. Hobbs, de natura aëris, *etc.* pp. viii + 67. Genevæ 1695.

—— Tractatus varii continentes nova experimenta circa relationem inter flammam & aerem et circa explosiones, *etc.* pp. iv + 120. Genevæ 1696.

—— Generalia capita pro historia naturali regionum majorum vel minorum, *etc.* pp. iv + 39. Genevæ 1696.

—— Excellentia theologiæ cum naturali philosophia, *etc.* pp. viii + 87. Genevæ 1696.

At the next Ordinary Meeting on **Thursday**, April **1st**, 1909, at 8.30 p.m., the following papers will be communicated:

"The affinity values of certain alkaloids." By V. H. Veley.

"The preparation and properties of the *N*-tribromo-substituted hydrazines usually styled the diazoperbromides." By F. D. Chattaway.

"The coloured salts and derivatives of the thiovioluric acid group." Preliminary note. By P. C. C. Isherwood.

"Nitrosoacetylamino-derivatives of the benzene and diphenyl series." By J. C. Cain.

"Observations on phycoerythrin, the pigment of the red algæ." By E. K. Hanson.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 29/4/09

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 25. No. 355.

Thursday, March 25th, 1909, Annual General Meeting, Sir William Ramsay, K.C.B., F.R.S., President, in the Chair.

Dr. G. Barger and Mr. W. B. Tuck were appointed Scrutators, and the ballot was opened for the election of Officers and Council for the ensuing year.

The President presented the Report of the Council on the progress of the Society during the past twelve months, and the Treasurer, after making a statement as to the Society's income and expenditure for the year 1908, proposed a vote of thanks to the Auditors, which was seconded by Dr. H. G. Colman and acknowledged by Dr. A. Harden and Dr. V. H. Veley.

The adoption of the Report of Council together with the Balance Sheet and Statements of Accounts for the year ended 31st December, 1908, was proposed by Prof. J. Norman Collie, and seconded by Mr. John Spiller. After some remarks by Dr. E. Divers, the motion was put to the Meeting and carried unanimously.

REPORT OF THE COUNCIL.

The Council once more have the satisfaction of stating that the prosperity of the Society continues, both the number of papers read and the number of Fellows on the list showing a considerable increase.

On the 31st December, 1907, the number of Fellows was 2,896 During 1908, 159 Fellows were elected, and 4 were reinstated, thus making a gross total of 3,059. The Society has lost 31 Fellows by death; 38 have resigned; 2 elections have become void, and the names of 38 Fellows have been removed from the list for non-payment of Annual Subscriptions.

The total number of Fellows, therefore, at the 31st December 1908, was 2,950, showing an increase of 54 over the number for the previous year.

The names of the deceased Fellows, with the dates of their election are:

J. H. Ball (1902).
S. Banner (1888).
B. H. Brough (1884).
J. T. Cart (1907).
A. V. Cunnington (1898).
A. Deck (1874).
Sir J. Evans (1876).
E. A. Fasnacht (1902).
R. J. Friswell (1871).
Sir J. C. Gamble (1876).
T. A. Gerard (1904).
W. M. Habirshaw (1874).
R. H. Harland (1876).
F. W. Hart (1869).
A. Helms (1894).
A. Houldershaw (1901).
R. V. Jackson (1881).
J. G. Johnson (1872).
W. H. Jowett (1891).
F. H. Leeds (1891).
T. Morson (1851).
H. L. Pendlebury (1907).
J. H. Player (1860).
W. A. Shenstone (1876).
A. Sibson (1859).
F. G. Smith (1903).
E. Sonstadt (1874).
Sir T. Stevenson (1864).
B. H. Thwaite (1880).
A. Wade (1908).
T. H. Walker (1879).

The following Fellows have resigned:

J. Alexander.
J. A. Basker.
F. W. Bayly.
J. H. Belcher.
L. H. Berry.
W. R. Cooper.
A. J. Cownley.
D. C. Crichton.
C. Crocker.
F. W. Daw.
F. A. Drake.
L. Dufty.
G. C. Fry.
T. Gough.
A. H. Green.
H. L. Greville.
E. G. Guest.
C. G. Kiddell.
W. J. Lockyer.
J. Marsh.
L. W. Mathieson.
E. W. Millar.
E. Morris.
W. D. Page.
H. Ross.
H. Rostron.
H. Senier.
F. Shedden.
E. C. Sherwood.
E. S. Smith.
W. Southworth.
A. Turner.
G. J. Ward.
R. Waterhouse.
T. Whittaker.
W. H. Wood.
J. W. Yates.

and Professor A. Haller, whose name has been transferred from the list of Ordinary Fellows to that of the Honorary and Foreign Members.

The number of those Fellows elected prior to 1860 has been diminished by the death of Mr. Thomas Morson, elected on December 15th, 1851, and of Mr. Alfred Sibson, who was elected on December 15th, 1859.

The Council have great pleasure in congratulating Professor William Odling and Mr. E. A. Pontifex on having reached the 60th Anniversary of their Election as Fellows of the Society; the following Fellows during the past two or three years have reached their Jubilee as Fellows:

Prof. A. H. Church (1856).
Sir W. Crookes (1857).
Mr. E. Davies (1858).
Mr. J. F. Davis (1857).
Prof. G. Carey Foster (1856).
Mr. C. Hanbury (1857).
Prof. J. W. Mallet (1857).
Mr. F. Norton (1854).
Sir H. E. Roscoe (1855).
Mr. P. J. Worsley (1858).

The number of Honorary and Foreign Members at the close of 1907 was 29. Seven were elected in February, 1908, but during the past year the Society has had to mourn the death of Professor A. H. Becquerel and of Professor Wolcott Gibbs, thus making the total of Honorary and Foreign Members, at the close of 1908, to be 34. Since then, however, Professor Emil Erlenmeyer and Professor Julius Thomsen, F.R.S., have passed away. Arrangements are being made for the preparation of Memorial Lectures, and that dealing with the life work of Professor Wolcott Gibbs will be delivered by Dr. Frank Wigglesworth Clarke early in June.

A general scheme of co-operation with the Royal Society in the matter of Obituary Notices has been formulated; it will now be possible to issue those relating to deceased Fellows in the publications of both Societies, subject to the consent of the author.

During the year 1908, 278 scientific communications have been made to the Society, 212 of which have been published already in the Transactions, and abstracts of all have appeared in the Proceedings.

The volume of Transactions for 1908 contains 2,281 pages, of which 2,188 are occupied by 222 memoirs, the remaining 93 pages being devoted to the Obituary Notices, the Report of the Annual General Meeting, and the Presidential Address; the volume for the preceding year contains 205 memoirs, which occupy 2,021 pages.

The Journal for 1908 contains also 4,978 abstracts of papers published mainly in foreign journals, which extend to 2,112 pages, whilst the abstracts for 1907 numbered 4,686, and occupied 2,100 pages. The abstracts for 1908 may be classified as follows :—

PART I.

	Pages.	No. of Abstracts.
Organic Chemistry	1,032	1,879

PART II.

	Pages.	No. of Abstracts.
General and Physical Chemistry		936
Inorganic Chemistry		588
Mineralogical Chemistry		97
Physiological Chemistry		567
Chemistry of Vegetable Physiology and Agriculture		265
Analytical Chemistry		646
	1,080	3,099
Total in Parts I. and II.	2,112	4,978

In July, 1908, the Linnean Society celebrated the fiftieth anniversary of the presentation, by C. R. Darwin and A. R. Wallace, of the essay entitled "On the tendency of species to form varieties, and on the perpetuation of varieties and species by natural means of selection"; on this occasion the Chemical Society was represented by the Foreign Secretary, Dr. Horace T. Brown. Another jubilee of especial interest, held in October, was that of the Foundation of the Oxford University Museum, which followed upon the establishment of a Natural Science School at Oxford; at this ceremony the President, Sir William Ramsay, offered to the University the congratulations of the Society.

Late in 1907, the President was nominated on the deputation organised by the British Science Guild, which subsequently represented to the Postmaster-General the desirability of reducing postage rates for the publications of learned Societies; this deputation was received by the Postmaster-General on March 12th, 1908, but his reply was not sympathetic. Following this action, a memorandum on the subject was prepared, and forwarded to certain members of Parliament, some of whom communicated in the matter with the official representatives of the Post Office in the House; the majority of these members, however, were of opinion that it is undesirable to raise this question again at present.

The Society has become indebted to Professor J. Emerson Reynolds for a bust of Michael Faraday.

In May, 1908, a petition, signed by more than three hundred

Fellows, was presented to the Council requesting them to ascertain the wishes of the Society as a whole regarding the admission of women to the Fellowship of the Society. Acceding to the request of the memorialists, the Council directed the Secretaries to issue a letter, drawn up by the Council, in which arguments on both sides were set forth, requesting each Fellow to consider these, and to express his opinion on the ballot paper enclosed therewith. The referendum having closed on October 1st, the scrutators reported that 1,758 voting papers had been received, of which 1,094 were in favour of admitting women, and 642 against the proposal, whilst 22 were neutral. Two Extraordinary Meetings of Council were devoted solely to the consideration of this result, and it was resolved, by a considerable majority, "That in the opinion of this Council it is desirable that at any time, on recommendation of three Fellows of the Society, women be accepted as Subscribers to the Society. Such women Subscribers shall pay an annual fee of thirty shillings: they shall be admitted to all ordinary meetings of the Society: they shall have the same use of the Library as the Fellows, and they shall be supplied with the Proceedings, Transactions, and Annual Reports of the Society as these are issued." The considerations which led the Council to adopt this course are set forth in the statement drawn up by the Council and made by the President at the Ordinary Scientific Meeting on December 17th, 1908 (*Proceedings*, 1908, **24**, 277).

The validity of this resolution having been called in question (*Proceedings*, 1909, **25**, 1), the terms of the resolution and of the criticisms thereon were referred to the legal advisers of the Society, Messrs. Bristows, Cooke and Carpmael, who report as follows:

"In our opinion, the Council had power to pass this resolution. The privileges thereby proposed to be given do not in any way make women subscribers Corporators, and it was because if women were elected Fellows they would become Corporators, that Counsel, in April, 1904, advised they should not be elected Fellows.

"(1) So far as we are aware (taking the parts of the Resolution one by one), there is nothing to prevent women subscribing an annual fee to the Society, or to prevent the Society accepting such fee. Gifts are from time to time made to the Society. The Charter provides that the Council shall have the sole management of the income and Funds of the Society.

"(2) The Resolution also provides that women shall be admitted to all ordinary meetings of the Society. We understand that this has always been the custom.

"(3) The Resolution next provides that the women shall have the same use of the Library as the Fellows. So far as we are aware, there is nothing in the Charter or By-Laws to prevent this, but if it is proposed that the books shall be allowed to circulate among the women Subscribers, then we think that By-Law 15 would have to be altered.

"(4) Lastly, the Resolution provides that women subscribers shall be supplied with the Proceedings, Transactions, and Annual Reports of the Society as these are issued. We see nothing contrary to the Charter or By-Laws in this, and, further, we understand that any member of the public at present has this facility at prices fixed by the Council."

The triennial award of the Longstaff Medal to the Fellow of the Society who, in the opinion of the Council, has done the most to promote Chemical Science by Research, was made, on the recommendation of the Research Fund Committee, to Professor Frederic Stanley Kipping, F.R.S. The medal will be presented at the Annual General Meeting on March 25th, 1909.

The Council have regretfully accepted the resignation of Mrs. Dougal. A special vote of thanks has been accorded to Mrs. Dougal in recognition of the valuable assistance which she has rendered to the Society during the past fifteen years in indexing its Publications. Dr. C. H. Desch having resigned the position of Assistant Sub-Editor, an arrangement has been made by which all branches of the editorial work will become concentrated in the hands of Dr. Cain and Mr. Greenaway.

Following the important gift of books by Sir Henry Roscoe mentioned in the Report of the Council for 1906, the munificence of the same donor has enriched the Library with a series of periodicals comprising 636 volumes. The Society is indebted also to Mrs. Sonstadt, Mr. Edward Davies, and Professor W. R. E. Hodgkinson, for the gift of valuable sets of books.

The number of books borrowed from the Library during 1908 was 1,339 as against 1,317 in the previous year. The additions to the Library, excluding those already mentioned, comprise 159 books, of which 90 were presented, 412 volumes of periodicals (representing 245 journals), and 36 pamphlets, as against 138 books, 401 volumes of periodicals (representing 243 journals), and 40 pamphlets last year.

In further response to the appeal of the Council referred to in the Report of last year, several Fellows have presented volumes of periodicals to help to complete the sets in the Library. The appeal has also stimulated Fellows to present to the Library a number of early chemical works. The Council welcome gifts of this description, as, in the words of Professor Emerson Reynolds, speaking from the Presidential Chair in 1902, "it is desirable that the Society should have in the Library one copy, at least, of every work printed in English on chemical subjects to the end of the eighteenth century." Each of these gifts has been acknowledged in the Proceedings from time to time.

In consequence of the crowded condition of the Library, it has been again found necessary to construct ten bookcases in the basement; this extension, however, can afford only temporary relief.

The annual income of the Research Fund now amounts to about £346, and this year, as a fair balance was also in hand, grants amounting to £368 were made. In the Transactions for 1908, there are 31 papers contributed by authors who have received grants from the Research Fund.

With regard to the income and expenditure of the Society for the year just closed, there is but little calling for special comment, as both are on the same lines as those of last year. The total income for 1908 is £7,134 17*s.* 2*d.*, which is less than that of the previous year by £125 7*s.* 8*d.*; the expenditure is £6,834 15*s.*, or only £84 6*s.* 7*d.* more than that of last year. This leaves an excess of £300 2*s.* 2*d.* of income over expenditure for the year's working, as compared with £509 16*s.* 5*d.* for 1907, and £741 13*s.* 2*d.* for 1906. It may seem somewhat remarkable that, with an increase of 50 in our list of Fellows, we should have a smaller income from admission fees and from annual subscriptions, which are the items in which there is the most notable falling off. This is, however, accounted for by the large number elected in November and December, whose subscriptions and admission fees do not become due until January 1st, 1909, and therefore do not appear as arrears in the 1908 account, but will swell the income for 1909. This will be welcome to the Treasurer, for the preparation for Vol. V. of the Decennial Index (which has even now begun) must be actively proceeded with by our Editor under the arrangements just concluded. The *Journal* has cost £192 2*s.* 6*d.* more than last year, but a saving of £37 15*s.* 6*d.* has been effected on the *Proceedings.* Administrative expenses are £54 5*s.* 4*d.* less than last year, due to our economies in several directions being greater than increased expenditure in others, but the total effect has been to secure greater efficiency. It is obvious, however, that unless authors will actively aid the Publication Committee in their endeavours to keep down the continual increase in the cost of the *Journal*, it will be necessary to raise the annual subscription from £2 (which it has been ever since the foundation of the Society) to £2 10*s.*

Dr. DIVERS having given due notice that he would move the adoption of the following new Bye-Law:

XIII *bis.—On Ascertaining the Will of the Society by means of Voting Papers.*

> "The President, either on his own motion or on a written requisition by the Council or by fifty Fellows, shall proceed to ascertain the will of the Society as to any suggested change in the Bye-Laws or in the administration of these laws by the Council, by causing to be delivered, along with the Proceedings or separately, a notice to each Fellow of the change proposed, together with a voting paper upon it, to be filled in by the Fellow and returned to the Secretaries not later than a prescribed date. After that date, the results of the voting shall be counted by the Secretaries and two Scrutineers, appointed by the President, and be reported by him to a Council Meeting and to a General Meeting, upon which the Council shall proceed to act in accordance with the majority of votes, as being the expression of the will of the majority,"

the President declared that his duty prevented him from putting the proposition to the Meeting, the suggested Bye-Law being repugnant to the Charter. Dr. Divers then withdrew his Resolution, and gave notice that at a subsequent General Meeting he would propose the Bye-Law so amended that the word "may" replace the word "shall."

The President then presented the Longstaff Medal for 1909 to Professor F. S. Kipping, who responded in terms expressing his appreciation of the honour bestowed upon him.

A vote of thanks to the Treasurer, Secretaries, Foreign Secretary and Council for their services during the past year was proposed by Dr. L. T. Thorne, seconded by Dr. McGowan, and acknowledged by Prof. H. E. Armstrong.

The President then delivered his address, entitled "Elements and Electrons." Prof. J. J. Dobbie proposed a vote of thanks to the President coupled with the request that he would allow his address to be printed in the Society's Transactions, the motion being seconded by Prof. F. S. Kipping, and acknowledged by the President.

The Scrutators having presented their report, the President declared that the following had been elected as Officers and Council for the ensuing year.

President: Harold B. Dixon, M.A., F.R.S.

Vice-Presidents who have filled the Office of President: H. E. Armstrong, Ph.D., LL.D., F.R.S.; A. Crum Brown, D.Sc., LL.D., F.R.S.; Sir William Crookes, D.Sc., F.R.S.; Sir James Dewar, M.A., LL.D., F.R.S.; A. Vernon Harcourt, M.A., D.C.L., F.R.S.; Raphael Meldola, F.R.S.; H. Müller, Ph.D., LL.D., F.R.S.; W. Odling, M.A., M.B., F.R.S.; Sir William Ramsay, K.C.B., LL.D., F.R.S.; J. Emerson Reynolds, Sc.D., M.D., F.R.S.; Sir Henry E. Roscoe, LL.D., F.R.S.; W. J. Russell, Ph.D., F.R.S.; T. E. Thorpe, C.B., LL.D., F.R.S.; W. A. Tilden, D.Sc., F.R.S.

Vice-Presidents: J. Campbell Brown, D.Sc., LL.D.; J. Norman Collie, Ph.D., F.R.S.; J. J. Dobbie, M.A., D.Sc., F.R.S.; F. Stanley Kipping, D.Sc., Ph.D., F.R.S.; Sir Alexander Pedler, C.I.E., F.R.S.; James Walker, D.Sc., Ph.D., F.R.S.

Treasurer: Alexander Scott, M.A., D.Sc., F.R.S.

Secretaries: M. O. Forster, D.Sc., Ph.D., F.R.S.; A. W. Crossley, D.Sc. Ph.D., F.R.S.

Foreign Secretary: Horace T. Brown, LL.D., F.R.S.

Ordinary Members of Council: Julian L. Baker; George T. Beilby, F.R.S.; William A. Bone, D.Sc., Ph.D., F.R.S.; Alfred C. Chapman; Julius B. Cohen, Ph.D., B.Sc.; Charles E. Groves, F.R.S.; J. T. Hewitt, M.A., D.Sc., Ph.D.; W. R. E. Hodgkinson, Ph.D.; H. R. Le Sueur, D.Sc.; G. T. Morgan, D.Sc.; A. G. Perkin, F.R.S.; A. E. H. Tutton, M.A., D.Sc., F.R.S.

ANNIVERSARY DINNER.

The Anniversary Dinner of the Society was held at the Whitehall Rooms, Hotel Metropole, on Thursday, March 25th, 1909, at 7 p.m., at which the following Guests and Fellows were present:

Applebey, Mr. M. P.
Armit, Dr. H.
Baker, Mr. J. L.
Balfour of Burleigh, Rt. Hon. Lord, *Chancellor, St. Andrews University.*
Barclay, Mr. E., *President, Institute of Brewing.*
Barger, Dr. G.
Barrett, Mr. W. H.
Barry, Sir J. Wolfe-, *Chairman, Executive Committee, City and Guilds of London Institute.*
Beadle, Mr. C.
Bell, Sir Hugh, *President, Iron and Steel Institute.*
Berncastle, Mr. R.
Bevan, Mr. E. J.
Borns, Dr. H.
Bovey, Dr. H. T., *Rector, Imperial College of Science and Technology.*
Bowley, Mr. J. J.
Brown, Prof. A. J.
Cain, Dr. J. C., *Editor.*
Carr, Mr. S. E., *Assistant Secretary.*
Chapman, Mr. A. C.
Cholmeley, Dr. H. P.
Chree, Dr. C., *President, Physical Society.*
Clifford, Mr. F. W., *Librarian.*
Collins, Sir William J., *Vice-Chancellor, London University.*
Colman, Dr. H. G.
Connah, Mr. J.
Cozens-Hardy, Rt. Hon. Sir H. H., *Master of the Rolls.*
Crichton-Browne, Sir James, *Treasurer, Royal Institution.*
Crookes, Sir William, *Past President.*
Crossley, Prof. A. W., *Hon. Secretary.*
Daily Telegraph, The.
Dale, Dr. H. H.
Divers, Prof. E.
Dobbie, Prof. J. J., *Vice-President.*
Dyer, Dr. B.
Edwards, Mr. S. A.
Elborne, Mr. W.

Elder, Mr. H. M.
Evans, Mr. P. M., *Clerk, Clothworkers' Co.*
Exeter, Rt. Rev. Lord Bishop of.
Feilmann, Dr. M. E.
Fenton, Dr. H. J. H.
Forster, Dr. M. O., *Hon. Secretary.*
Gardner, Mr. W. S., *Master, Drapers' Co.*
Geikie, Sir Archibald, *President, Royal Society.*
Goodenough, Mr. F. W.
Greenaway, Mr. A. J., *Sub-Editor.*
Griffiths, Mr. T. P., *Prime Warden, Dyers Co.*
Gwyer, Dr. A. G. C.
Harden, Dr. A.
Harker, Dr. G.
Hartley, Mr. H.
Hewitt, Dr. J. T.
Hill, Mr. C. A.
Hodgkinson, Prof. W. R. E.
Holt, Mr. A.
Hooper, Mr. E. G.
Howard, Mr. D.
Huntley, Mr. G. N.
Jowett, Dr. H. A. D.
Keeble, Mr. A. J.
Keeble, Mr. H.
Kemp, Mr. W. J.
Kipping, Prof. F. S., *Vice-President.*
Lapworth, Dr. A.
Lessing, Dr. R.
Le Sueur, Dr. H. R.
Little, Dr. G.
Lockyer, Sir J. Norman, *Chairman, British Science Guild.*
Lowry, Dr. T. M.
Macdonald, Prof. J. S.
MacEwan, Mr. P.
McGowan, Dr. G.
Maltwood, Mr. J.
Matthews, Dr. F. E.
Meldola, Prof. R., *President, Society of Chemical Industry.*
Messery, Mr. G. T.
Metcalfe, Mr. F. E.
Miers, Dr. H. A., *Principal, London University.*
Mills, Dr. W. H.
Mohr, Dr. B.
Mondy, Mr. E. F.
Moody, Dr. G. T.
Morant, Sir Robert L., *Permanent Secretary, Board of Education.*
Morgan, Dr. G. T.
Morning Post, The.
Morrell, Dr. R. S.
Morris, Mr. H., *President, Royal College of Surgeons.*
Müller, Dr. H., *Past President.*
Murphy, Mr. P.
Ogilvie, Mr. F. G., *Principal Assist.-Sec., Board of Education.*
Orton, Prof. K. J. P.
Pearson, Mr. G. E.
Perkin, Prof. W. H., *Vice-President.*
Ping, Mr. W.
Pope, Prof. W. J.
Power, Dr. F. B.
Prain, Lt.-Col. D., *Director, Kew Gardens.*
Press Association, The.
Prideaux, Sir W. S., *Clerk, Goldsmiths' Co.*
Ramsay, Sir William, *President.*
Ramsay, Mr. W. G.
Reay, Rt. Hon. Lord, *Chairman, University College.*
Reynolds, Prof J. E., *Past President.*
Roberts, Mr. F. A., *Master, Grocers' Co.*
Russell, Dr. W. J., *Past President.*
Scott, Dr. A., *Treasurer.*
Scott, Dr. D. H., *President, Linnean Society.*
Scudder, Mr. F.
Sidgwick, Dr. N. V.
Spielmann, Dr. P. E.
Standard, The.
Steward, Mr. H. A., *Master, Skinners' Co.*
Struthers, Dr. John, *Secretary, Scotch Education Dept.*
Tatlock, Mr. R. R., *President, Society of Public Analysts.*
Thomas, Mr. N. G.
Thorpe, Dr. J. F.
Tidy, Dr. H. L.
Tilley, Mr. J. W.
Tilley, Mr. V. J.
Times, The.
Tizard, Mr. H. T.
Townshend, Col. G. R.
Vasey, Mr. S. A.
Veley, Dr. V. H.
Voelcker, Dr. J. A.
Warren, Mr. T. H., *Vice-Chancellor, Oxford University.*
White, Sir Wm. H., *Vice-President, Society of Arts.*
Williams, Rt. Hon. Sir Roland Vaughan, *Lord Justice of Appeal.*
Winstanley, Mr. H., *Master, Clothworkers' Co.*
Wissler, Mr. F.
Wood, Sir H. Trueman, *Secretary, Society of Arts.*
Yates, Mr. H. J.
Young, Dr. G.
Young, Mr. J. Rymer, *President, Pharmaceutical Society.*

The following Toasts were proposed :

By THE PRESIDENT.

1. **His Most Gracious Majesty the King.**
2. **Her Majesty the Queen Alexandra, their Royal Highnesses the Prince and Princess of Wales, and the other Members of the Royal Family.**

By SIR HUGH BELL, Bart.,

President of the Iron and Steel Institute.

3. **The Chemical Society**, coupled with the name of *The President.*

By Professor RAPHAEL MELDOLA, F.R.S.,

Past President of the Chemical Society.

4. **The City and Guilds of London**, coupled with the names of F. A. ROBERTS, Esquire, *Master of the Worshipful Company of Grocers*, and WALTER S. GARDNER, Esquire, *Master of the Worshipful Company of Drapers.*

By Professor H. A. MIERS, F.R.S.,

Principal of the University of London.

5. **Scientific Societies**, coupled with the name of SIR ARCHIBALD GEIKIE, K.C.B., F.R.S., *President of the Royal Society.*

By Professor J. EMERSON REYNOLDS, F.R.S.,

Past President of the Chemical Society.

6. **The Guests**, coupled with the names of The Right Honourable LORD BALFOUR OF BURLEIGH, K.T., P.C., *Chancellor of the University of St. Andrews*, and SIR JAMES CRICHTON-BROWNE, F.R.S., *Treasurer of the Royal Institution.*

The Royal Toasts having been duly honoured, Sir Hugh Bell, Bart., President of the Iron and Steel Institute, in proposing The Chemical Society, coupled with the name of The President, said that no branch of human industry owed a greater debt to the science which that Society had been formed to promote than the Iron and Steel Trade. In every branch of that industry, chemical science was continually assisting, and without it they would be unable to conduct those intricate operations which resulted in such a large measure of well-being to the human family. Even to battleships, of which so much had been heard of late, the President had contributed not a little, but he, Sir Hugh, preferred to emphasise the peaceful side of their industry, and their gratitude to Chemistry and the President of the Chemical Society was rather for having promoted peace, not warfare. It was a science which, if properly used, might be largely instrumental in the education of the youth of our country. Of all the sciences, Chemistry was that one which compassed most completely the true objects of experimental science, seeking always for its verification the repetition of the phenomena under investigation. It too frequently happened, however, that what was called chemical instruction was merely a "messing about" with test-tubes which did no good to any living soul. If it were indeed necessary to exclude all test-tubes from technical departments—even if they had thereby to exclude Chemistry itself—they might be doing something of real benefit to education.

Sir William Ramsay, in responding to the toast, reviewed in an interesting manner the chief events associated with the Society since his entrance into the Society in 1873. He gave a number of interesting and amusing reminiscences of many of the pioneers of modern science with whom he had come into personal contact. Alluding to the inutility of examinations in testing the ability of chemists, he regarded such examinations in the light of a necessary evil. They were inadequate to gauge the abilities of a chemist, which depended upon other mental qualities than readiness, quick-wittedness, and good memory. The latter were undoubtedly useful qualities, but what the chemist more particularly required was the power to obtain accurate results by means of long-continued thought and careful observation. The Chemical Society was expanding in its influence at home and abroad, and had now nearly 3,000 Fellows, and had children and grandchildren in the form of chemical societies practically everywhere, but more especially in the Colonies and the United States. He could not venture to predict what the future of Chemistry might be. The days of the Admirable Crichton were gone, and it was now impossible to be proficient in all branches of human knowledge. It was therefore more necessary than ever that the chemist should know something about everything in Chemistry, and everything about some particular branch of it. There was an overwhelming output of chemical knowledge, and it was hopeless to attempt to read all the books published nowadays. His advice to authors of works on Chemistry was to reduce them to the irreducible minimum, taking care to be lucid, concise, and sufficiently comprehensive. One aim of the Society should be to promote courses of lectures, summing up particular subjects so as to extend the general knowledge of Chemistry. This was very essential, as owing to the accumulation of detail, specialisation was very necessary, but the disadvantage of this was that persons were apt to have no great knowledge of, or interest in, the work of those engaged in other branches of their science. Chemistry was becoming more and more essential in all branches of life, and exercised a great influence in war and peace. That influence would increase, and he had no doubt that the Chemical Society would flourish in the future as it had done in the past.

Professor **Raphael Meldola**, Past President of the Chemical Society, proposed the toast of "The City and Guilds of London," coupled with the names of Mr. F. A. Roberts, Master of the Worshipful Company of Grocers, and Mr. Walter S. Gardner, Master of the Worshipful Company of Drapers. It was a popular belief, declared Prof. Meldola, that City Companies were associated solely with City banquets and gorgeous palaces. As a servant of those Companies taking cognizance of what was going on in the upper regions, he could assure them that the holding of banquets was not their sole object of existence. We were perhaps familiar with their efforts in the cause of charity, but he wished to allude to the assistance they gave to the cause of education and science. It was thirty years since the cry of "Technical Education" was raised in this country. That cry meant that there was not a sufficiently close association between Science and Industry. The City and Guilds threw themselves into the breach, and boldly undertook the pioneering work of Technical Education in this country. They took over the work that the State had not touched hitherto, and the foundation of the City and Guilds of London Institute was the outcome; and during the period from 1878 to 1908, fifty-two City Companies contributed to that Institute £768,360 to advance the cause of British Technical Education.

Mr. F. A. **Roberts**, responding for the Worshipful Company of Grocers, reciprocated the kindly sentiments of Prof. Meldola. The Company were prepared to continue their good work, but hoped that there would be no outside interference with them, as he believed they were employing their money to the best interests of science, education, and charity.

Mr. **Walter S. Gardner** responded for the Worshipful Company of Drapers, and referred to the useful work of their Company in the matter of apprentices, a work which they hoped would mitigate to some extent the evil of sending boys out at an early age to earn a few shillings a week for three or four years, after which they become practically unfit for anything of service to the community.

Professor H. A. Miers, proposing the toast of "Scientific Societies," coupled with the name of Sir Archibald Geikie, President of the Royal Society, said the tendency was for Societies to go on multiplying and specialising. The work of specialisation was becoming so serious that the fear was that when a paper was read at a Scientific Society nowadays, the only person who at all understood it was the author himself. Perhaps such a circumstance had its own field of usefulness, and he reminded them of the man who left £10,000 in his will to the Society whose meetings had proven such an excellent antidote to insomnia. He hoped that some method could be found to make use of the splendid amateur materials of which the various Scientific Societies consisted. Whether the Societies were making the best use of their opportunities or not, there was one extremely wholesome sign about their present state—they were in no danger of becoming a Joint Mutual Admiration Society, but were living in the bracing atmosphere of criticism which was undoubtedly useful in the promotion of their work as a whole.

Sir Archibald Geikie, in response, said that Science had grown enormously of late. There was the danger, as the President had pointed out, that specialisation would go on so far that the votary of one branch of science should be entirely unacquainted with what was taking place in another branch of it. It was a very bad thing, he declared, for a man to live in water-tight compartments of knowledge. It would enlarge his views if he took in something from other spheres of knowledge. Something, he was glad to say, was being done in that direction, and none of the Societies moving that way had attained greater success than the Chemical Society.

Professor J. Emerson Reynolds proposed the toast of "The Guests," and alluded in warm terms to Lord Balfour of Burleigh and Sir James Crichton-Browne, whose names were coupled with the toast.

Lord Balfour of Burleigh responded as the unworthy representative of the Church, which had disappeared, of the law which was still worthily represented, and of various educational authorities whom he saw before him, and to whom he had been in servitude on former occasions.

Sir James Crichton-Browne, also responding to the toast of "The Guests," said it was delightful to know that the members of the Royal Family, including His Majesty the King, were showing a great and intelligent interest in the work of the Royal Institution, which he, Sir James represented. That interest was being extended to the forthcoming Congress at the Albert Hall. As to the general outlook, we had fallen upon lean years. We had with us Unemployment and sombre anticipations of the next Budget. We looked to the Chemists for new knowledge which should not only enable us to redress some of the evils we saw around us, and, in a utilitarian sense, largely add to the comfort and convenience of human life, but which, better still, should make for the clarification of our conceptions of the Universe and for the refinement and ennobling of our lives.

Thursday, April 1st, 1909, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., F.R.S., President, in the Chair.

It was announced that the Council had appointed the following Committees for 1909—1910:

Finance Committee: Messrs. E. G. Hooper, G. T. Moody, T. E. Thorpe, W. A. Tilden, and the Officers.

House Committee: Messrs. W. R. Dunstan, J. E. Reynolds, W. J. Russell, J. M. Thomson, T. E. Thorpe, W. A. Tilden, and the Officers.

Library Committee: Messrs. E. C. C. Baly, F. D. Chattaway, B. Dyer, W. Gowland, A. Harden, C. A. Keane, A. Lapworth, E. J. Mills, J. M. Thomson (Chairman), J. A. Voelcker, J. Wade, the Editor, and the Officers.

Publication Committee: Messrs. W. R. Dunstan, C. E. Groves, J. T. Hewitt, A. McKenzie, R. Meldola, G. T. Morgan, T. E. Thorpe, and the Officers.

Research Fund Committee: Messrs. G. T. Beilby, J. N. Collie, A. D. Hall, A. Liversidge, R. Meldola, R. Messel, Sir A. Pedler, W. H. Perkin, J. E. Reynolds, W. A. Tilden, and the Officers.

Certificates were read for the first time in favour of Messrs.:

John Harold Edge, Great Marld, Smithills, Bolton.
Harold Hibbert, M.Sc., Ph.D., Creston, Marple Bridge, Derbyshire.
Roland Josiah May, Granaugh Villa, Dunbar, N.B.
Thomas Napier, Arbiene, Clarkston, Busby.

Of the following papers, those marked * were read:

*97. "The affinity values of certain alkaloids."

By Victor Herbert Veley.

Determinations have been made of the affinity value of some of the more important alkaloids by the methyl-orange and borax precipitation methods, the latter only being put forward as giving approximate results in cases in which the electric conductivity and ester catalysis methods cannot be applied.

It was shown that the affinity values of only a few alkaloids are less than $1 \cdot 10^{-7}$, those of the greater number are between the limits of $1 \cdot 10^{-7}$ and $3 \cdot 10^{-5}$ (value of ammonia), and lastly, only a few have a value higher than the last figure, and hence may be classed with the tetra-alkylammonium hydroxides.

It appears that when alkaloids consist of two conjoint residues which, if considered each by itself, would give affinity values of a widely different order, such as piperidine or benzylamine, on the one hand, and quinoline or pyrrolidine, on the other, the stronger residue is modified by the presence of the weaker. It seems to be immaterial whether each residue contains a nitrogen atom, and whether such an atom is common to both.

The affinity values determined by the methods applied, and collected together for the sake of comparison, illustrate the difficulty of obtaining salts, B,2HCl, in the case of certain dinitrogen alkaloids.

DISCUSSION.

Prof. KIPPING understood that the author's method was based on the first appearance of a permanent precipitate of the alkaloid; but as some alkaloids were soluble in solutions of some salts, a fact which was often observed in dealing with compounds containing silicon, he asked if the formation of a precipitate indicated corresponding conditions in all cases?

Dr. LESSING asked the author if he had found any marked difference in affinity values of tropine derivatives with the nitrogen in the α- and β-positions respectively to the carboxyl group. Willstätter and he found some years ago that with regard to exhaustive methylation, pyrrolidine- and piperidine-carboxylic acids may be classified into two groups, namely, those of the ecgonine type, corresponding with β-amino-acids, in which methylation effects the disruption of the ring, and those of the α-ecgonine type, corresponding with α-amino-acids, which resist all attempts to open up the ring.

Dr. VELEY replied that the point of initial precipitation of the alkaloid by the hydrolysed borax solution was perfectly sharp in all cases examined with the single exception of papaverine; the precipitate initially formed redissolved at first quickly, and subsequently more slowly. The method proposed could only be applied for alkaloids the solubility of which in water was of the order 1 : 1000.

The affinity values of tropine and its derivatives had been dealt with in a previous communication.

There appeared to be a certain confusion in the minds of certain writers between basicity and affinity values; although there was, doubtless, some correlation between these two factors, yet in the present state of our knowledge it appeared prudent to keep them quite distinct from one another.

*98. "Phycoerythrin, the pigment of the red algæ."
By Edward Kenneth Hanson.

Phycoerythrin has been investigated as to (1) its action with regard to light and (2) its chemical nature. With respect to the first point, Schütt (*Ber. Deut. bot. Ges.*, 1888, 6, 307) has shown that phycoerythrin absorbs bluish-green light and gives an orange fluorescence. The author has confirmed this observation and has further photographed the fluorescence spectrum, thus succeeding in demonstrating that the fluorescent light gives *two* bands coincident with two of the absorption bands of chlorophyll. This is in harmony with the hypothesis that phycoerythrin assists assimilation in deep-water plants by absorbing the light available at these depths and degrading it to yellow and red light which can be utilised by the chlorophyll.

With regard to the chemical nature of phycoerythrin, the evidence is very inconclusive, owing to the impossibility (up to the present) of obtaining pure phycoerythrin. Molisch (*Bot. Zeit.*, 1894, 177) has suggested that the pigment is protein; but it does not give the biuret reaction, and its nitrogen-content is too low (not much greater than 6 per cent.) for a true protein. It is, however, a colloid, soluble only in water, and precipitated by the ordinary protein precipitants, and appears to be related to proteins, as it yields leucine on hydrolysis with acids. It is attacked by trypsin, but not by pepsin.

DISCUSSION.

Mr. CHASTON CHAPMAN said it had occurred to him that the colouring matter of certain red torulæ which he was examining, and which appeared to be very closely allied to carotene, might conceivably be of some assistance to the organism in protecting the protoplasm from the injurious effects of the violet rays of light. He had made experiments on this point and had found that these organisms, unlike many of the yeasts, grew equally well whether exposed to red or violet rays. He did not see, however, that in the case of the algæ referred to by the author, any such protective effect could come into play.

Dr. FEILMANN suggested that dyeing experiments on the material might throw some light on the chemical nature and composition of the colouring principle; it might, for instance, be possible in this way to discover whether the substance contained nitrogen, by dyeing on to cotton and then testing for that element.

The PRESIDENT asked how the author was sure that algin was not precipitated with the colouring matter.

In reply, Mr. HANSON said that no experiments had been made in dyeing. The solution of phycoerythrin in pure water deteriorated very rapidly, but the presence of a small amount of eucalyptus oil or other antiseptic enabled solutions to be kept, even if exposed to light, for months. In answer to the President's questions, he did not consider that separation from algin was complete: that was, indeed, the chief difficulty in attempting to study the chemical nature of phycoerythrin. Boiling with sodium carbonate decolorised the solution. With regard to Dr. Cain's suggestion, the solid material had not been tested for bromine or iodine, and although it gave a qualitative reaction for sulphur, an amount sufficient for quantitative estimation had not been found.

*99. "*iso*Amygdalin and the resolution of its hepta-acetyl derivative." By Frank Tutin.

Since *iso*amygdalin crystallises only with difficulty, and melts indefinitely at relatively so low a temperature (125—140°), the author considers that it does not consist of a definite, partially racemic compound, but is merely a mixture of amygdalin and the corresponding derivative of *d*-mandelonitrile. Moreover, it appears that the latter derivative predominates, since the mandelic acid yielded by *iso*amygdalin is slightly dextrorotatory.

As *iso*amygdalin itself cannot be fractionally crystallised in a satisfactory manner, its acetyl derivative has been employed. This has been separated into its components, namely, hepta-acetylamygdalin and the hepta-acetyl derivative of the unknown stereoisomeride of amygdalin. *Hepta-acetyl*neo*amygdalin*, $C_{34}H_{41}O_{18}N$, crystallises in long needles, melts at 174°, and has $[\alpha]_D - 65{\cdot}6°$ in chloroform. On hydrolysis with concentrated hydrochloric acid, it yields *d*-mandelic acid.

*100. "The stability of compounds derived from tertiary amines and magnesium alkyl halides." By Harold Hibbert.

A determination of the chemical "*affinergy*" of diethylaniline for magnesium methyl iodide by the method previously described by the author (this vol., p. 57) shows a very low value relative to that of monoethylaniline. This is in agreement with the observation of Tschelinzeff (*Ber.*, 1907, **40**, 1495), that the heat of combination of diethylaniline with magnesium propyl iodide is very small. It follows from these two facts that the quaternary compound, $NEt_2Ph \cdot MgMeI$, must be relatively very unstable. The author has been able to show that this instability is a general property of the compounds derived from tertiary amines, decomposition into free base and magnesium alkyl halide occurring at 200—280°. This is true of the derivatives from triethylamine, tripropylamine, diethylaniline, and dimethylaniline; pyridine forms an exception. The original amine is obtained whether magnesium ethyl bromide or magnesium methyl iodide is employed, and this point is being investigated with a larger number of alkyl halides.

*101. "A new method for the separation of tertiary from secondary and primary amines." By Harold Hibbert and Archibald Wise.

The relative instability of the derivatives from tertiary amines and magnesium alkyl halides (see preceding note) led the authors to investigate the stability of the compounds derived from the action of magnesium alkyl halides on secondary and primary amines. It has been found that the derivatives R_2NMgI and $RNHMgI$ respectively are very stable substances, only decomposing when strongly heated, whereas the derivatives with tertiary amines decompose between 200° and 280°. Based on these facts the following simple method has been devised for the separation of tertiary amines from mixtures with secondary and primary amines: to the mixture of amines (either alone or in ethereal solution) is added a quantity of an ethereal solution of magnesium ethyl bromide sufficient to combine with the whole of the secondary (or primary, respectively) amine, together with 20—30 per cent.* of the theoretical amount required for the tertiary amine, and the product then distilled from an oil-bath. Ether distils over at first, followed as the temperature in the oil-bath rises to 200—280° by the pure tertiary amine. The last traces are swept out by dry hydrogen or other indifferent gas. The secondary (or primary, respectively) amine is recovered by adding water and distilling in a current of steam. Even when using very small quantities (for example, 5—10 grams) it is possible to recover 70—80 per cent. of the products in this way, and the tertiary amine is obtained quite free from secondary or primary amine. The method has been applied to the separation of the following mixtures: di- and tri-ethylamine, di- and tri-propylamine, mono- and di-methylaniline, mono- and di-ethylaniline, aniline and dimethylaniline.

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* This amount is sufficient on account of the very great difference in their chemical "*affinergies*" for the Grignard reagent.

102. "The preparation and properties of the *N*-tribromo-substituted hydrazines (the diazonium perbromides)." By Frederick Daniel Chattaway.

The preparation of the *N*-tribromophenylhydrazines from the hydrazines by substitution was described.

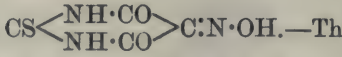
All the *N*-tribromohydrazines when brought into contact with free bromine combine with it and form compounds only stable under a considerable pressure of bromine vapour, in which the halogen is much less firmly attached than when replacing hydrogen combined with tervalent nitrogen.

In the preparation of the *N*-tribromohydrazines from diazonium salts, if liquid bromine is used, these unstable compounds are formed locally and have to be removed from the solid substituted hydrazines by washing with ether or exposure to the air. They are also formed when the *N*-tribromohydrazines are placed in water, these compounds being in part dissociated into diazonium salts and free bromine, the halogen set free combining to a considerable extent with the remainder of the *N*-substituted hydrazines and forming with them a more or less pasty mass.

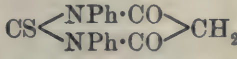
The behaviour of a number of *N*-tribromohydrazines when heated, when exposed to dry and moist air, when suspended in water or concentrated hydrochloric acid, and when dissolved in alcohol or acetic acid was also described.

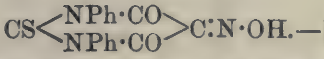
103. "The coloured salts and derivatives of the thiovioluric acid group." (Preliminary note.) By Percy Claude Cameron Isherwood.

In view of the interesting colour relations of the salts of the violuric acid group, the author is studying the influence of the replacement of oxygen by sulphur in this acid and some of its derivatives.



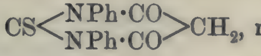
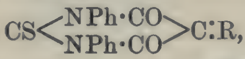
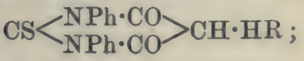
Thiovioluric Acid, $CS\begin{matrix}<NH\cdot CO> \\ <NH\cdot CO> \end{matrix}C{:}N\cdot OH$.—The *monosodium* salt of this acid has been prepared by the action of acetic acid on equivalent quantities of sodium thiobarbiturate and sodium nitrite in aqueous solution below 0°. From this the free acid was obtained in small, yellow needles by the action of cold dilute hydrochloric acid. Its aqueous solution has the characteristic violet colour. The following salts have been prepared and exhibit a wide range of colours: *lithium*, *sodium, potassium, ammonium, calcium, strontium, barium, magnesium, mercuric, lead, silver,* and *cadmium.*

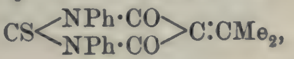
1 : 3-*Diphenylthiobarbituric Acid,*  $\mathrm{CS}<\substack{\mathrm{NPh\cdot CO}\\ \mathrm{NPh\cdot CO}}>\mathrm{CH_2}$.—This was prepared by heating together *s*-diphenylthiocarbamide, phosphoryl chloride, and malonic acid (compare Miss Whiteley, *Trans.*, 1907, **91**, 1330); it crystallises from alcohol in bulky, pale yellow needles.

1 : 3-*Diphenylthiovioluric Acid,*  $\mathrm{CS}<\substack{\mathrm{NPh\cdot CO}\\ \mathrm{NPh\cdot CO}}>\mathrm{C{:}N\cdot OH}$.—1 : 3-Diphenylthiobarbituric acid was dissolved in dilute ammonia and treated successively with equivalent quantities of sodium nitrite and acetic acid. A reddish precipitate of the above acid was formed. The work is being extended to other derivatives of thiovioluric acid, especially with a view to the examination of the colour and absorption spectra of solutions of salts.

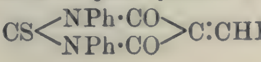
104. "Studies in the barbituric acid series. Part II. 1:3-Diphenyl-2-thiobarbituric acid and some coloured derivatives." By Martha Annie Whiteley and [the late] Harold Mountain.

In a recent paper by Hantzsch, "*Über Pantochromie und Chromoisomerie von Violuraten und verwandten Oximidoketon-Salzen*" (*Ber.*, 1909, **42**, 966), two references are made to work that is being conducted by R. Robison on diphenylvioluric acid; as this compound, the first of the aryl-substituted violuric acids, and a large number of its salts and derivatives were prepared by one of the authors (Whiteley, *Trans.*, 1907, **91**, 1330), and the work is still being continued, it was deemed advisable to describe further results obtained in this series.

1 : 3-*Diphenyl-2-thiobarbituric acid,*  $\mathrm{CS}<\substack{\mathrm{NPh\cdot CO}\\ \mathrm{NPh\cdot CO}}>\mathrm{CH_2}$, m. p. 244°, forms pale yellow needles, and condenses with aldehydes and ketones to yield compounds of the type  $\mathrm{CS}<\substack{\mathrm{NPh\cdot CO}\\ \mathrm{NPh\cdot CO}}>\mathrm{C{:}R}$, which are reduced to the corresponding saturated derivative,  $\mathrm{CS}<\substack{\mathrm{NPh\cdot CO}\\ \mathrm{NPh\cdot CO}}>\mathrm{CH\cdot HR}$; 5-iso*propenyl*-1 : 3-*diphenyl-2-thiobarbituric acid,*



$$\mathrm{CS}<\substack{\mathrm{NPh\cdot CO}\\ \mathrm{NPh\cdot CO}}>\mathrm{C{:}CMe_2},$$

m. p. 260—262°, forms canary-yellow prisms; 5-iso*propyl*-1 : 3-*diphenyl-2-thiobarbituric acid,* m. p. 237—240°, is pale yellow; 5-*benzylidene-1 : 3-diphenyl-2-thiobarbituric acid,*  $\mathrm{CS}<\substack{\mathrm{NPh\cdot CO}\\ \mathrm{NPh\cdot CO}}>\mathrm{C{:}CHPh}$, m. p. 254°, forms orange-yellow prisms; 5-*benzyl*-1 : 3-*diphenyl*-2-*thiobarbituric acid*, $\mathrm{CS}{<}{\mathrm{NPh\cdot CO} \atop \mathrm{NPh\cdot CO}}{>}\mathrm{CH\cdot CH_2Ph}$, m. p. 187°, forms pale yellow needles; 5-o-*nitrobenzylidene*-1 : 3-*diphenyl*-2-*thiobarbituric acid*,

$$\mathrm{CS}{<}{\mathrm{NPh\cdot CO} \atop \mathrm{NPh\cdot CO}}{>}\mathrm{C{:}CH\cdot C_6H_4\cdot NO_2},$$

m. p. 236°, forms dull orange needles, and 5-*cinnamylidene*-1 : 3-*diphenyl*-2-*thiobarbituric acid*, $\mathrm{CS}{<}{\mathrm{NPh\cdot CO} \atop \mathrm{NPh\cdot CO}}{>}\mathrm{C{:}CH\cdot CH{:}CHPh}$, m. p. 278°, forms brilliant, crimson, prismatic needles.

1 : 3-Diphenyl-2-thiobarbituric acid and its 5-aryl-substituted derivatives condense with aromatic diazonium chlorides to form the corresponding hydrazone or azo-derivative: 1 : 3-*diphenyl*-2-*thioalloxanphenylhydrazone*, $\mathrm{CS}{<}{\mathrm{NPh\cdot CO} \atop \mathrm{NPh\cdot CO}}{>}\mathrm{C{:}N\cdot NHPh}$, m. p. 291°, forms brilliant, orange, prismatic needles; 1 : 3-*diphenyl*-2-*thioalloxan*-p-*nitrophenylhydrazone*, $\mathrm{CS}{<}{\mathrm{NPh\cdot CO} \atop \mathrm{NPh\cdot CO}}{>}\mathrm{C{:}N\cdot NH\cdot C_6H_4\cdot NO_2}$, m. p. 288°, crystallises in orange-red needles, and 5-*benzeneazo*-1 : 3-*diphenyl*-5-*benzyl*-2-*thiobarbituric acid*, $\mathrm{CS}{<}{\mathrm{NPh\cdot CO} \atop \mathrm{NPh\cdot CO}}{>}\mathrm{C}{<}{\mathrm{CH_2Ph} \atop \mathrm{N{:}NPh}}$, m. p. 135°, crystallises in yellow needles.

Two isomeric varieties of 1 : 3-diphenyl-2-thiovioluric acid have been obtained differing in colour and melting point, and a similar isomerism has been observed among the pyridine, piperidine, and alkali salts of the acid. *α*-1 : 3-*Diphenyl*-2-*thiovioluric acid*, $\mathrm{CS}{<}{\mathrm{NPh\cdot CO} \atop \mathrm{NPh\cdot CO}}{>}\mathrm{C{:}N\cdot OH}$, m. p. 211—212°, obtained by the action of ethyl nitrite on 1 : 3-diphenyl-2-thiobarbituric acid, forms deep red, prismatic needles, and a bluish-violet hydrated *acid*, $\mathrm{CS}{<}{\mathrm{NPh\cdot CO} \atop \mathrm{NPh\cdot CO}}{>}\mathrm{C{:}N\cdot OH,H_2O}$, is obtained by the action of sodium nitrite and hydrochloric acid on the barbituric acid; *β*-1 : 3-*diphenyl*-2-*thiovioluric acid* (probably),

$$\mathrm{CS}{<}{\mathrm{NPh\cdot CO} \atop \mathrm{NPh\cdot CO}}{>}\mathrm{C}{<}\begin{matrix}\mathrm{NH}\\ |\\ \mathrm{O}\end{matrix},$$

m. p. 224°, is obtained as a yellowish-brown, crystalline powder when the pyridine salt is heated at 100° or boiled with alcohol. The *piperidine* salt, $\mathrm{C_{16}H_{11}O_3N_3S,C_5NH_{11}}$, exists in two crystalline forms, one grey, m. p. 181—182°, and one pale red, m. p. 187°; the two varieties of the *pyridine* salt, $\mathrm{C_{16}H_{11}O_3N_3S,CNH_5}$, are green and dull red respectively. The *potassium* salt, $\mathrm{C_{16}H_{10}O_3N_3SK}$, is obtained in dark olive-green, cubic crystals by the action of potassium hydroxide on the *α*-violuric acid; the *sodium* salt, $\mathrm{C_{16}H_{10}O_3N_3SNa}$, is similarly obtained in rose-red needles; when, however, an alcoholic solution of 1 : 3-diphenyl-2-thiobarbituric acid is added to an aqueous solution of potassium or sodium nitrite, the potassium or sodium salt of 1 : 3-diphenyl-2-thiovioluric acid is obtained as a violet or purple, microcrystalline powder respectively. The *ferrous* salt, $(C_{16}H_{10}O_3N_3S)_2Fe$, is a deep blue, crystalline powder with a purple reflex.

The melting points recorded in this preliminary communication are in all cases temperatures of decomposition, and therefore vary with rate of heating.

105. "Nitrosoacetylamino-derivatives of the benzene and diphenyl eries." By John Cannell Cain.

In continuation of previous work (*Trans.*, 1908, **93**, 681), the author has prepared the following compounds : 2-*Nitrosoaceto*-p-*toluidide*,

$$NO\cdot C_6H_3Me\cdot NHAc,$$

pale yellowish-brown crystals, m. p. 195° ; 6-*nitroso*-m-*toluidide*, green needles, m. p. 128—129° ; 5-*nitrosoaceto-o-toluidide*, green needles, m. p. 135—136° ; 2-*chloro*-4-*aminoacetanilide*, $NH_2\cdot C_6H_3Cl\cdot NHAc$, pale yellow plates, m. p. 111° ; 2-*chloro*-4-*nitrosoacetanilide*, green needles, m. p. 112—113°, and 3 : 3′-*dichloro*-4 : 4′-*diacetyldiaminoazobenzene*,

$$NHAc\cdot C_6H_3Cl\cdot N_2\cdot C_6H_3Cl\cdot NHAc,$$

pale yellow needles, m. p. 280°.

The monoacetyldiamines of the diphenyl series can readily be prepared by the action of acetic anhydride on an aqueous alcoholic solution of the corresponding base. *Monoacetyltolidine*,

$$NHAc\cdot C_6H_3Me\cdot C_6H_3Me\cdot NH_2,H_2O,$$

forms white, shining plates, m. p. 103°, and on oxidation with Caro's acid yields 4-*nitroso*-4′-*acetylamino*-3 : 3′-*ditolyl*,

$$NO\cdot C_6H_3Me\cdot C_6H_3Me\cdot NHAc,$$

pale brown crusts, m. p. 154—155°. Monoacetylbenzidine on similar treatment furnishes 4-*nitroso*-4′-*acetylaminodiphenyl*,

$$NO\cdot C_6H_4\cdot C_6H_4\cdot NHAc,$$

yellowish-brown, feathery needles, m. p. about 275°.

106. "The rate of reaction of the triphenylmethane dyes with acid and alkali. Part. II. Brilliant green and malachite green." By Nevil Vincent Sidgwick and Tom Sidney Moore.

In a previous paper (*Zeitsch. physikal. Chem.*, 1907, **57**, 385) the authors have investigated the rate of reaction of brilliant green (the salt of tetraethyldiaminotriphenylcarbinol) with alkali and with hydrochloric acid. They have now examined the action of nitric acid on this dye, and that of nitric and hydrochloric acids and of alkali on the corresponding tetramethyl compound, malachite green. The method adopted in all cases was to determine the concentration of the dye by measuring the colour of the solution in a Donnan tintometer.

The behaviour of the two dyes was found to be very similar, and also that of the two acids.

(1) The velocity of formation of the carbinol in presence of alkali is proportional to the product of the concentrations of the dye and the alkali, and is found to be more than twice as great as that deduced for much higher concentrations by Gerlinger (*Ber.*, 1904, **37**, 3958) from the conductivity measurements of Hantzsch and Osswald (*Ber.*, 1900, **33**, 278). This is probably due to the dye-base not being wholly ionised, and would be accounted for by a dissociation constant of 0·00531, about four times that of diethylamine.

(2) Acids act on the dye-salt to form a colourless acid salt, and at equilibrium $k_1 \times C_{\text{dye-salt}} \times C_{\text{acid}} = k_2 \times C_{\text{acid salt}}$, where k_1/k_2 is independent of the strength of the acid, but k_1 and k_2 vary inversely as the cube root of the concentration of the acid.

(3) When a solution of the carbinol is treated with acid, it first yields the dye-salt, which is then converted reversibly into the acid salt. The velocity of this last reaction being known, that of the first can be determined. A graphic method, due to Mr. H. G. J. Moseley, was described, by which the velocity can be calculated from the somewhat complicated expression obtained, which does not admit of direct solution. The velocity is proportional to the concentration of the carbinol, and to the two-thirds power of that of the acid.

The various constants obtained for the two dyes and for the two acids show a very close agreement, the difference never amounting to 25 per cent., and in most cases being much smaller.

107. "The rate of reaction of the triphenylmethane dyes with acid and alkali. Part III. Diaminotriphenylcarbinol." By Nevil Vincent Sidgwick and Albert Cherbury David Rivett.

The velocity of reaction of this unsubstituted dye was determined by the same method. The general results are similar, but the constants are all larger, and certain modifications are introduced by the fact that this dye is a much weaker base.

(1) With alkali the reaction is unimolecular as before, but the constant increases much more slowly than the alkali, owing no doubt to the dye-base being largely undissociated. The observed results agree with those calculated for a dissociation constant of 0·0004 (about 1/12 of that of brilliant green) when the alkali is not too weak. They indicate that if the carbinol is formed from the non-ionised portion of the dye-base, this dye reacts 1·6 times as fast as brilliant green,

but if from the ions, 21 times as fast. The former view is therefore more probable.

(2) If a solution of the dye is treated with a small quantity of acid, its colour increases, owing to the disappearance of hydrolysis, whilst a further addition of acid diminishes the colour, from the formation of the acid salt. In $N/125,000$-solution the dye is hydrolysed to the extent of 33·5 per cent., giving the dissociation constant of the base as $7·5 \times 10^{-9}$. This obviously refers to the system (carbinol $\rightleftharpoons$ dye-base) at equilibrium, and is 50,000 times less than the constant of the dye-base itself. This is an instance of the true "abnormal hydrolysis" of a pseudo-base.

The constants k_1 and k_2 of the formation and dissociation of the acid salt (see preceding paper) vary inversely as the square root (instead of the cube root) of the concentration of the acid.

(3) The action of acid on the carbinol is the same as in the previous cases, the unimolecular constant M being proportional to the two-thirds power of the strength of the acid.

The values of these constants (compared by reference to a normal acid) are in all cases higher for this dye than for the alkylated derivatives, brilliant green and malachite green, k_1 being about 7 times, k_2 1·5 times, and M 3 times as great.

108. "Indican. Part II." By Arthur George Perkin and Frederick Thomas.

p-Nitrobenzaldehydeindogenide, $C_{15}H_{10}O_3N_2$ (Baeyer, *Ber.*, 1881, **14**, 1745), is readily formed by hydrolysing indican with acid in the presence of *p*-nitrobenzaldehyde, and the reaction may be employed for the quantitative estimation of the glucoside. In this respect piperonal is not so serviceable, and the yield of *methylenedioxybenzaldehydeindogenide* $C_{16}H_{11}O_3N$, orange needles, m. p. 223—224°, by the process employed was but 96 per cent. *Dihydroxybenzaldehydeindogenide*, $C_{15}H_{11}O_3N$, from indican, acid, and protocatechualdehyde, orange-red needles, m. p. 264—265°, soluble in strong alkali with a blue colour, and dyeing mordanted fabrics, is more difficult to isolate, owing to the formation of brown secondary products. The *acetyl* derivative,

$$C_{15}H_9O_3N(C_2H_3O)_2,$$

orange needles, melts at 182°. *Hydroxybenzaldehydeindogenide*, from *p*-hydroxybenzaldehyde, $C_{15}H_{11}O_2N$, orange-red needles, m. p. 267—269°, soluble in alkali with a red coloration, gives the *acetyl* compound, $C_{15}H_{10}O_2N,C_2H_3O$, orange leaflets, m. p. 223—224°, and is not a dyestuff. The *p*-nitro- and methylenedioxy-benzaldehydeindogenides can easily be prepared in quantity by employing the leaf extracts of *I. sumatrana* and *I. arrecta* in the place of pure indican.

When indican is hydrolysed by sulphuric acid (4 c.c in 1000 c.c. of water) at 60°, simultaneously oxidising with air, the yield of colouring matter is but 85 per cent., due in part to the formation of brown secondary products. The latter reaction does not so readily occur when the equivalent quantity of hydrochloric acid is employed, and the yield of colouring matter (about 93·5 per cent.) is thus higher. In addition to indigotin, indirubin is also formed in some quantity under these conditions. Stronger solutions of sulphuric and hydrochloric acids at the boiling point in absence of air give respectively with indican identical brown products insoluble in alkali, from which, in addition to the indoxyl brown previously described (*Trans.*, 1907, **91**, 1715), an analogous substance more sparingly soluble in alcohol (Found, N = 9·65) was isolated.

The action of acid in the cold for a longer period (compare Schunck and Roemer, *Ber.*, 1879, **12**, 2311) has a similar effect, and indoxyl brown is thus formed. The brown product obtained from the leaf extracts of the *Indigoferae* by means of acid differs from indoxyl brown in that it is soluble in alkali, and appears to arise from a condensation of indoxyl with other compounds derived from the plant. In view of recent discussion on the melting point of dextrososazone (Tutin, *Proc.*, 1907, **23**, 250), the pure sugar derived from indican was converted into its acetyl derivative, and this was identical with acetyldextrose.

109. "Indican. Part III." By Frederick Thomas, William Popplewell Bloxam, and Arthur George Perkin.

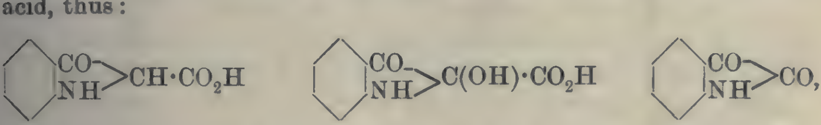
The authors have carried out experiments on the hydrolysis of pure indican by means of indimulsine, its specific enzyme (Beyerinck, *Proc. K. Akad. Wetensch. Amsterdam*, 1899, **1**, 120; Hazewinkel, *ibid.*, 1900, **2**, 512, and van Romburgh, *ibid.*, 1899, **2**, 344), and on the air oxidation of the solutions of indoxyl thus produced under a variety of conditions. The results indicate that, owing to the unstable nature of indoxyl, changes occur both during the fermentation and oxidation processes which prevent these reactions from proceeding in a quantitative manner. The best yields of colouring matter were given when a small amount of acid was present during the fermentation (compare Beyerinck, *loc. cit.*), and the fermented liquid was then oxidised in the presence of a trace of ammonia.

110. "Indoxylic acid." By Arthur George Perkin.

The examination of a sample originally consisting of commercial indoxylic acid, which had remained unopened for some years, showed that no indoxyl or indoxylic acid was now present. The product contained:

Matter soluble in alkali	32·94 per cent.
Indirubin	42·37 ,,
Indigotin	17·30 ,,
Moisture	2·15 ,,
Ash	1·05 ,,
Insoluble in nitrobenzene by difference	4·19 ,,

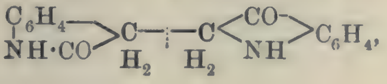
The oxidation involved appears to have arisen from the gradual admission of air, and whereas the formation of indigotin is easily accounted for, it is considered that the predominance of indirubin has arisen from the formation, in the first place, of isatin from ψ-indoxylic acid, thus:



and its subsequent condensation with indoxyl. That portion of the matter soluble in alkali contained isatin and an acid resembling phenylglycine-*o*-carboxylic acid, but the main bulk consisted of an amorphous, brown product, from which was isolated a brown substance very closely resembling and possibly identical with the chief constituent of the indigo-brown (*Trans.*, 1907, **91**, 279) which is present in natural indigo. The examination of two other products derived in the same manner from indoxylic acid gave results of a similar character, and it thus appears likely that in these circumstances the changes involved are of a normal character.

111. "The reduction of indirubin." By Arthur George Perkin.

It has been shown by Fasal (*Mitt. K. Tech. Gew-mus. Wien*, 1895, 307) that when indirubin is reduced by zinc dust and alkali under conditions of indigo-vat practice, the indirubin-white at first formed soon undergoes further reduction, indoxyl being thus produced, and this in the dyeing operation is converted into indigotin. A study of the reaction with a large quantity of indirubin derived from an extract of *I. sumatrana* by means of isatin has shown that under these conditions oxindole is also produced, and this, obtained in colourless needles, m. p. 120°, was identified by means of its nitroso-compound, m. p. 204—206°, and by oxidation with ferric chloride to isatin. The formation of indoxyl and oxindole is readily understood by reference to the following scheme:



$$\begin{array}{l}C_6H_4-\\ \,| \\ NH\cdot CO\end{array}\!\!>\underset{H_2}{C}-\vdots-\underset{H_2}{C}<\begin{array}{l}CO-\\ NH\end{array}\!\!>C_6H_4,$$

and the behaviour of indirubin in this respect does not suggest that its presence in natural indigo can be economically advantageous. In addition to oxindole, a small quantity of a yellow basic substance resembling the di-indole of Schutzenberger (*Jabresb.*, 1877, 511), $C_{16}H_{14}N_2$, was also formed in this reaction. A quantitative study of the reduction of indirubin by this method is in progress.

112. "Solubility of lead sulphate in concentrated solutions of sodium and potassium acetate." By John Jacob Fox.

The increased solubility of lead sulphate in concentrated solutions of sodium and potassium acetates is due to the formation of lead acetate in solution, conclusive evidence being obtained from the examination of the system potassium acetate–lead sulphate. In this case no sulphate was dissolved, although as much as 19 per cent. of lead acetate was found in one of the solutions. As regards the system sodium acetate–lead sulphate, the proportion of sulphate in solution was equivalent to the lead dissolved.

The solid phase in the potassium acetate system was altered, lead potassium sulphate, $PbK_2(SO_4)_2$, being formed, but no corresponding double salt was obtained from the sodium acetate system. The absence of double salt in the latter case probably arises from the fact that the amount of sodium sulphate formed from the lead sulphate by sodium acetate is insufficient, considered alone, to saturate the solution at 25°. The solubility curve for sodium sulphate in sodium acetate solution is entirely different in character from that of potassium sulphate in potassium acetate, the solubility in the latter case decreasing rapidly with increasing concentration of the potassium acetate.

Although the solubility of lead sulphate is shown to be due to the formation of lead acetate in solution, the solubility curves do not coincide with those derived from the system lead acetate–alkali acetate, since the presence of sulphates in the solid phases tends to reduce the solubility of the lead.

113. "The colour and constitution of the alkyl iodides of cyclic bases." By Charles Kenneth Tinkler.

From an examination of the absorption spectra of the methiodides of cyclic bases, it is suggested that the colour of the alkyl iodides is due to polymerisation, the linking taking place between the iodine atoms.

A similar view was recently put forward by Hantzsch (*Ber.*, 1909, **42**, 68). The results of molecular-weight determinations in support of this view were communicated to Dr. Decker by the author in November, 1907, but were not published.

Phenylacridine methiodide in chloroform is termolecular, and the solution, like the solid substance, is strongly coloured (compare Hantzsch, *loc. cit.*).

Molecular-weight determinations carried out in diphenylamine solution by the cryoscopic method also indicate that the substances when coloured are polymerised. It was pointed out that the alkyl iodides of piperidine and tetrahydroquinoline derivatives are colourless.

114. "A method for investigating dissociation equilibria in solutions, and its application to the study of aqueous potassium mercuri iodide solutions." By Harry Medforth Dawson.

A method for the investigation of dissociation equilibria in solutions was described. The type of equilibrium in question may be represented by the reversible equation $A + mB \rightleftarrows AB_m$, according to which one mol. of the substance unites with m mols. of B to form the dissociating complex compound AB_m.

The method consists in adding to the solution of A and B a third substance C, which also combines with A to form a dissociating compound AC_n, the dissociation constant of which is known. If the concentration of uncombined C in the solution is determined, that of the compound AC_n follows at once, and by combining these data with the dissociation constant of the compound AC_n, the concentration of uncombined A in the solution can be obtained. Under certain conditions this leads at once to a knowledge of the molar ratio of A to B in the compound AB_m.

The method has been applied to the examination of solutions of mercuric iodide in potassium iodide. The experimental results show that the amount of potassium iodide which is combined with a given quantity of mercuric iodide diminishes as the relative concentration of the mercuric iodide in the solution increases. In solutions which contain relatively little mercuric iodide, the compound $2KI,HgI_2$ is the chief complex constituent; on the other hand, solutions which are nearly saturated with mercuric iodide contain the complex compound $3KI,2HgI_2$ as the chief constituent.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Geological Society of London. The Centenary. Celebrated September 26th to October 3rd, 1907. Recorded by *W. W.* **Watts.** pp. iv + 166. ill. London 1909. (*Recd.* 6/3/09.) From the Society.

Simmons, *William Herbert,* and **Appleton,** *H. A.* The handbook of soap manufacture. pp. vii + 159. ill. London 1908. (*Recd.* 18/3/09).
From Mr. W. H. Simmons.

II. *By Purchase.*

Henrich, *Ferdinand.* Neuere theoretische Anschauungen auf dem Gebiete der organischen Chemie. pp. xiv + 294. Braunschweig 1908. (*Recd.* 25/3/09.)

Meyer, *Hans.* Analyse und Konstitutionsermittelung organischer Verbindungen. 2nd edition. pp. xxxii + 1003. Berlin 1909. (*Recd.* 31/3/09.)

Möhlau, *Richard,* and **Bucherer,** *Hans Th.* Farbenchemisches Praktikum zugleich Einführung in die Farbenchemie und Färbereitechnik. pp. x + 374. ill. Leipzig 1908. (*Recd.* 31/3/09.)

Parry, *Ernest J.* The chemistry of essential oils and artificial perfumes. 2nd edition. pp. viii + 546. ill. London 1908. (*Recd.* 25/3/09.)

Volhard, *Jacob.* Justus von Liebig. 2 vols. pp. xii + 456, viii + 438. ill. Leipzig 1909. (*Recd.* 31/3/09.)

Wedekind, *E.* Die Entwicklung der Stereochemie des fünfwertigen Stickstoffs im letzten Jahrzehnt. (Sammlung, Vol. XIV). Stuttgart 1909.

III. *Pamphlets.*

Bihar Planters' Association. Report of the Indigo Research Station, Sirsiah, for the year 1908–1909. By *Cyril* **Bergtheil.** pp. 24. Calcutta 1909.

Blount, *Bertram.* The composition of commercial petrols. [Paper read before the Incorporated Institution of Automobile Engineers on March 10th, 1909.] pp. 6. London 1909.

Duvivier, *Carl.* Recherches sur la préparation électrolytique des composés du plomb. pp. 19. Malines 1909.

Golding, *John.* Adaptation. (From the *Report and Trans. Nottingham Nat. Soc.*, **56**, 1907–1908.)

WOLCOTT GIBBS MEMORIAL LECTURE.

The above lecture will be delivered by Professor Frank Wigglesworth Clarke at the Ordinary Scientific Meeting on **Thursday**, June **3rd, at 8.30** p.m.

At the next Ordinary Meeting, on **Thursday**, May **6th**, 1909, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated :

"Affinity constants of hydroxy- and alkyloxy-acids." By A. Findlay, W. E. S. Turner, and Miss G. E. Owen.

"The absorption spectra of the nitrates in relation to the ionic theory." By E. C. C. Baly, Miss K. A. Burke, and Miss E. G. Marsden.

"The chlorination of acetanilide." By W. J. Jones and K. J. P. Orton.

"Esterification constants of substituted acrylic acids. Part IV." By J. J. Sudborough and M. J. P. Davies.

"Action of the halogens on aromatic hydrazines." By F. D. Chattaway.

"Studies in the camphane series. Part XXVI. Aryl derivatives of iminocamphor." By M. O. Forster and T. Thornley.

ERRATA.

1909. Pp. 65 and 81 *for* "Vol. 26" *read* "Vol. 25."

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, May 6th, 1909.

Bennett, Hugh Garner, M.Sc. (Leeds),
13, Spring Grove Terrace, Leeds.

Assistant Lecturer and Demonstrator at the Leather Industries Department of the University of Leeds. The candidate was a student at the Leeds University, 1902—1905, took then the degree of B.Sc. with First Class Honours in Chemistry, and has since been on the staff in the Leather Department. He was admitted to the degree of M.Sc. in 1907. He has published the following papers: "Studies in Chlorination. The Chlorination of the Isomeric Chloronitrotoluenes" (Cohen and Bennett, *J.C.S.*, 1905, 320); "A Method for the Examination of Marine Oils" (Procter and Bennett, *J. Soc. Chem. Ind.*, 1906, 798). A series of papers on the "Analysis of Tanning Materials" (*J. Soc. Chem. Ind.*, 1906, 251; 1906, 1203; 1907, 79; 1907, 455; 1907, 1186; *Collegium*, 1907, 37; 1908, 98.) "The Tannage of Sole Leather with Mimosa Bark" (*J. Soc. Chem. Ind.*, 1908, 1193).

Henry R. Procter. J. B. Cohen.
A. G. Green. Arthur Smithells.
William A. Bone.

Blackburn, Albert Riley,
"Marshville," Derby Road, Widnes, Lancs.

Senior Chemistry Master, Secondary Day and Municipal Technical School, Widnes. B.Sc. (London University). A.R.C.S. Fifteen years' experience as a teacher of Chemistry.

George Tate. Frank Baker.
Thomas J. Roberts. A. J. Allmand.
Henry Bassett, jun.

Burt, Frank Playfair,

Elmhyrst, Weston-super-Mare.

Student. B.Sc. (London). 1851 Exhibition Science Research Scholar, 1906–8. Researches on: (1) "Atomic Weight of Nitrogen, based on Analysis of Nitrogen Sulphide" (not yet completed); (2) "On the Atomic Weight of Chlorine," with Dr. R. W. Gray (abstract published in *J.C.S.*).

William Ramsay. A. W. Stewart.
N. T. M. Wilsmore. R. W. Gray.
Edward C. Cyril Baly.

Campbell, Walter,

Albert House, Westcliff-on-Sea, Essex.

Brewer and Brewer's Analyst. Eighteen months assistant to Mr. John Heron, and now acting as chemist to Messrs. Friary, Holyroyd, and Healey's Breweries, Ltd., Guildford, Surrey.

John Heron. F. Stanley Benton.
Arthur R. Ling. John M. Heron.
Alfred Chaston Chapman. *L. T. Thorne.*
Lawrence Briant.

Caulkin, Howard Alfred,

"Oaklands," Solihull, Warwickshire.

Analytical Chemist. Six years as pupil and assistant with Messrs. Southall Bros. and Barclay, Manufacturing and Analytical Chemists, Birmingham. B.Sc. (Lond.). A.I.C. (Analysis of Food and Drugs, etc.). Now Assistant Chemist to Midland Railway Co., Derby.

Percy F. Frankland. Thos. J. Murray.
Hamilton McCombie. C. K. Tinkler.
Alex. Findlay. E. W. Mann.

Chew, John Henry,

46, Lytham Road, Blackpool.

Chemist to the Blackpool Corporation Gas Department. Appointed Chemist to the Gas Department in 1905. Had charge of all Analytical work in connection with the above Gas department for the last four years, and assisting in same for the previous three years.

Douglas T. Setterington. C. J. Whittaker.
Thos. Duxbury. *Francis J. H. Coutts.*
George Naylor. *Chas. Horne Warner.*

Clarke, George,

Cawnpore.

Agricultural Chemist, Land Records and Agriculture Department, United Provinces, India. Chemistry Student, University College, Nottingham (1896—1901). Chemistry Demonstrator under Prof, Pope, F.R.S., Manchester Technical School. Fellow of the Institute of Chemistry. Formerly Teacher of Agricultural Chemistry [under Essex County Council]. Joint author (with F. S. Kipping) of a paper on "α-Amino-β-methylhydrindene," *Trans.*, 1903, 913, and (with Prof. W. J. Pope) on "The Resolution of Externally Compensated Dihydro-α-methylindole," *Trans.*, 1904, 1330. Author of a note on "A glucoside from Tephrosia purpurea," *Proc. Chem. Soc.*, 1909.

F. Stanley Kipping. W. J. Pope.
R. M. Caven. John Golding.
Henry J. S. Sand.

Cooke, Reginald Cyril Herbert,

17, St. Edmund's Terrace, Regent's Park, N.W.

Late Reduction Mine Manager. Educated at U.C.S., London, 5 years. Studied Chemistry for 2 years under Professor Meldola, Finsbury Technical College. Assistant Chemist, 3 years, to Mexican Gold and Silver Recovery Co. Reduction Mine Manager 3½ years to Consolidated Gold Fields of S. Africa, Rhodesia. Contributed a paper on "Treatment of Giant Mine Ore," Rhodesia, read before the C. M. M. Society of S. Africa, 21 Nov., 1908.

R. Meldola. E. W. Bealey.
John Castell-Evans. F. Henry Streatfeild.
George Dean.

Cooper, George Stanley,

Heaton House, Cleckheaton, Yorks.

Student of Chemistry. Intending to be Science Master. Studied for three years at King's College, London, and intend sitting for the B.Sc. exam. (Honours Chemistry) in October next. I desire to keep myself up to date in Chemistry and to keep in touch with research work in general.

John M. Thomson. Herbert Jackson.
Patrick H. Kirkaldy. *W. D. Halliburton.*
W. B. Bottomley.

Couch, Daniel Little,

9, Charlmont Road, Tooting, S.W.

Analytical and Technical Chemist. Student at Battersea Polytechnic and Central Technical College. Assistant Chemist at Messrs.

Brooke, Simpson and Spiller, Ltd., Hackney. Chemist at Walter Voss & Co., Ltd., Millwall, E.

S. G. Rawson. J. L. White.
J. Wilson. J. Hart Smith.
J. C. Cain.

Couzens, Edward Gordon,
47, Allfarthing Lane, Wandsworth.

Assistant Demonstrator, Royal College of Science. First Class Associateship of Royal College of Science in Chemistry. Second Class Honours B.Sc., London.

William A. Tilden. G. T. Morgan.
M. O. Forster. James C. Philip.
W. O. Wootton.

Creighton, Henry Jermain Maude,
Halifax, Nova Scotia, Canada.

Research Student. B.A. with High Honours and University Medal in Chemistry, Dalhousie University, 1906. M.A., Dalhousie University, 1907. 1851 Exhibition Science Research Scholar. Published: "Action of Radium on the Decomposition of Hydriodic Acid"; "A Few Chemical Changes Influenced by Radium, etc., etc."

Percy F. Frankland. Hamilton McCombie.
Alex. Findlay. Thomas H. Pope.
Adrian J. Brown.

Crewe, Philip Henry,
"Glencairn," Woods Moor, Stockport.

Analytical Chemist. Nine years Senior Assistant with Messrs. Jas. Woolley, Sons & Co., Ltd., Manufacturing Pharmaceutical Chemists, Manchester. *Author of*: Determination of Ferrous Carbonate in Pharmaceutical Preparations; Assay and Examination of Mercurial Ointment: read before the British Pharmaceutical Conference, 1907 and 1908.

L. G. Radcliffe. S. J. Peachey.
F. S. Sinnatt. John Allen.
Jul. Hübner.

Dyche-Teague, Francis Clifford,
8, Mount Road, Hendon, N.W.

Analytical Chemist and Bacteriologist. B.Sc., Birmingham; First Class in Chemistry. Late Assistant in Public Health Laboratory of the Metropolitan Boro' of Stepney. Analyst and Bacteriologist to Messrs. B. Davies & Sons, King St., W., and private practice.

Albert E. Parkes.	Hamilton McCombie.
Percy F. Frankland.	Thos. J. Murray.
Alex. Findlay.	Fredk. T. Harry.

Fowler, William,

3, Cranbrook Road, Victoria Docks, E.

Sugar Chemist. Eight years' connexion with Sugar Refining, and during the last year considerable experience with Brewing Sugars and Syrups, etc. Student at East Ham Technical College from 1905 until 1907. Student at Finsbury Technical College since 1907.

L. J. de Whalley.	Chas. R. Darling.
Arthur R. Ling.	J. Castell-Evans.

E. W. Bealey.

Grist, Charles James,

Apsley House, Banstead, Surrey.

Metallurgist. Taught Inorganic Chemistry in schools, and lectured to Army Candidates for a period of about six years. During the last fifteen years had been engaged upon the Vegetable Oils, Gums, and latterly upon the Analysis and Structure of Steel. Is a Member of the Iron and Steel Institute, and Fellow of the Entomological Society.

F. E. Matthews.	A. Campion.
F. W. Harbord.	W. R. Hodgkinson.

A. H. Coote.

Hargreaves, Egerton, M.Sc.,

"Arthog," Garner's Lane, Davenport, Stockport.

Lecturer in Chemistry. 1. Student at Owens Coll., Manchester, 1901–4. In 1903 took Ord. Final, B.Sc. (Chem. and Physics), and in 1904, Final Hons. Chem. (1st Class). M.Sc. granted in 1907. 2. Full charge of Chemical Dept. at Stockport Technical School since 1907. 3. Desire to become a Member chiefly in order to keep in touch with modern chemical research.

Harold B. Dixon.	H. F. Coward.
W. H. Perkin.	J. L. Simonsen.
J. F. Thorpe.	Norman Smith.

Haws, John Frederick,

Parkfield Villa, Newton-by-Frankby, Cheshire.

Science Teacher. Student of Chemistry, Liverpool School of Science, 1898–1901; Ditto, Central Technical School, 1902–5. For 6½ years with Professor J. Campbell Brown (as private secretary, 1903–7). Attended various day and evening classes in Chemistry at University (Liverpool), 1901–7; Summer Course (Chemistry), Royal College of Science, 1908. Assistant Demonstrator in Physiology and Hygiene, 1905, also Biology, 1906, and Botany, 1907, Central Technical School, Liverpool. 1st Class Hons. and King's Medal, Hygiene, 1907; Lecturer on Chemistry for Nat. Science Students, 1908.

J. Campbell Brown. G. T. Morgan.
Henry Bassett, jun. W. Collingwood Williams.
George Tate.

Hickinbotham, Reginald Vernon,
144, West Street, Maritzburg, Natal.

Analyst and Assayer. Six years at W. T. Henley's Telegraph Works as Assistant Chemist. Two years with Natal Paint Manufacturing Co., Ltd., Maritzburg, as Chemist and Manager, and four years as Public Analyst and Assayer.

R. L. Smith. R. J. Redding.
H. Russell Pitt. *H. Heron Smith.*
Wesley Lambert.

Hopkinson, Reginald, B.Sc. [Lond.].
Brimington House, Brimington, Nr. Chesterfield.

Science Teacher, Huntingdon Grammar School. Bachelor of Science (Chemistry), London University. Teacher of Chemistry for 6 years. Proceedings of Chemical Society required as an aid to research work.

J. H. Howgate. John T. Griffiths.
J. W. Shepherd. W. Carleton Williams.
Wm. Briggs.

Levy, Leonard Angelo,
60, Priory Road, West Hampstead, N.W.

Consulting Chemist. Chief chemist to Messrs. Sherard Cowper-Coles & Co., Ltd., 82, Victoria Street. B.Sc., Lond. (1st Class Honours in Chemistry). B.A. Cantab (1st Class, Parts I and II, Natural Science Tripos). A.I.C. "Some New Platinocyanides," *Trans. Chem. Soc.*, Vol. 89; "The Fluorescence of Platinocyanides," *Trans. Chem. Soc.*, Vol. 93. Two papers on Platinocyanides in *Proc. Camb. Phil. Soc.*

H. J. H. Fenton. W. J. Sell.
F. W. Dootson. H. O. Jones.
F. Ferraboschi.

Livsey, Harry,
54, Pemberton St., Old Trafford, Manchester.

Works Chemist at Messrs. J. & J. M. Worralls, Salford Branch of the English Velvet and Cord Dyers' Association. Employed as Chemist at the above works for the last 9½ years, and formerly Chemist at the Littleborough Dyeing Co., 2½ years. Student in the Chemistry and Dyeing Depts., etc., of the Royal Salford Technical Institute, 5 years. Anxious to have the opportunity of keeping in touch with Chemical Research.

J. R. Appleyard. J. S. Broome.
B. Prentice. E. Clark.
E. Green. D. V. Hollingworth.

Metzger, Floyd J.,

Columbia University, New York City, N.Y.

Instructor in Analytical Chemistry. "On Cæsium Antimony Fluorides and other Halides of Antimony," *Am. Jour. Sci.*, *XI*, 451; "On a Salt of Quadrivalent Antimony," *Am. Ch. J.*, **26**, 268; "On the Acid Nitrates," *Am. Ch. J.*, **26**, 271; "Thallic-thallous Nitrate," *Am. Ch. J.*, **26**, 277; "Separation of Tungstic and Silicic Acids," *Am. Ch. Soc.*, **23**, 356: with H. L. Wells. "A New Separation of Thorium, etc.," *Jour. Am. Chem. Soc.*, **24**, 901. "The Electrolytic Determination of Bismuth," with H. T. Beans, *Jour. Am. Chem. Soc.*, **30**, 589.

C. F. Chandler. Marston Taylor Bogert.
J. Livingston R. Morgan. Samuel A. Tucker.
Jas. S. C. Wells.

Müller, Robert,

Royal College of Science.

After the ordinary course of 3½ years at the "Polytechnikum" in Zürich, I succeeded in taking my Diploma examination. At present, I am working under Dr. Forster for my Ph.D.

James C. Philip. Chapman Jones.
G. T. Morgan. M. O. Forster.
Taylor Cook.

Okell, Frederick Leigh,

c/o Straits Trading Co., Singapore.

Analytical Chemist. Associate of the Institute of Chemistry. Chemical training received under Mr. W. F. Lowe, A.R.S.M., F.I.C., and at King's College, London, Sessions 1903–1905.

John M. Thomson. A. J. Greenaway.
Herbert Jackson. F. W. F. Arnaud.
Patrick H. Kirkaldy. Cecil Cooke Duncan.
W. F. Lowe. *L. C. Deverell.*

Owen, Robert Cecil,

89, Foregate St., Chester.

Chemist and Druggist and Science Lecturer. B.Sc. (London).

Lecturer in Science (chiefly Chemistry) to the Chester School of Science and to the Chester Society of Natural Science. Contributor to Pharmaceutical Papers.

John Bairstow.	W. F. J. Shepheard.
G. Watmough Webster.	John Welsh.

W. F. Lowe.

Rudolf, Norman Scott,
Bangalore, India.

Professor of Applied Chemistry at the Indian Institute of Science, Bangalore. M.Sc. (Victoria and Liverpool), F.I.C. 1893—1895 investigating chemistry of Indigo for Behar Planters, also in general analytical practice, holding appointment from Government of Bengal to examine potable waters on a fixed scale of fees. From 1895—1907 employed by Parke, Davis & Co., Manufacturing Chemists. In January, 1908, appointed to present position. Author of various papers published in Bulletin of Pharmacy, etc.

Morris W. Travers.	A. W. Titherley.
J. Campbell Brown.	Francis Francis.

Henry Bassett, jun.

Smith, Henry Llewellyn,
23, Ellingham Road, Shepherd's Bush, W.

Lecturer on Chemistry, King's College, London, and Lecturer on Applied Chemistry, Women's Department, King's College, London. B.Sc. (Manchester). Associate of the Institute of Chemistry. Part author, with Dr. Bone, of a paper on "The Thermal Decomposition of Formaldehyde and Acetaldehyde" (*Journal of the Chemical Society*, 1905, Vol. 87).

John M. Thomson.	W. H. Perkin.
Herbert Jackson.	C. F. Cross.

Cecil H. Cribb.

Strohmenger, Arthur Percy,
Bridgebank, Harrow-on-the-Hill.

Analytical Chemist. Chemist to The Tudor Accumulator Co., Ltd., Hart Accumulator Co., Ltd., The Cape Asbestos Co., Ltd.

R. Meldola.	E. W. Bealey.
John Castell-Evans.	John Spiller.

Cecil H. Cribb.

Tate, Arthur Edwin,
Gladstone House, Salter Row, Pontefract.

Senior Science Master at King's School, Pontefract, since 1906, and Junior Science Master (Chemistry) from 1905—1906. Science Master at Countess of Warwick's School for 2 years previous to the above appointment. Teacher of Chemistry in Evening Technical School, Pontefract.

P. Phillips Bedson.	S. Hoare Collins.
F. C. Garrett.	*J. T. Dunn.*
J. A. Smythe.	*John Pattinson.*

Thomas, Oswald John Dalgatty,

65, Clarendon Gardens, Ilford, Essex.

Analytical Chemist. Student, Finsbury Technical Institute. Pupil to Mr. W. J. Dibdin, F.I.C., F.C.S. Cement and Gas Works Chemist. Agricultural Chemist.

Alex. H. Bennett.	Robt. G. Grimwood.
F. H. Moore.	*Wm. P. Skertchly.*

Thos. Macara.

Tilley, Vernon James,

"Linthorpe," Becmead Avenue, Streatham, S.W.

Analytical Chemist. Associate of the Institute of Chemistry. Desirous of keeping in touch with the latest progress in chemical literature.

John M. Thomson.	Henry R. Lyell.
Tom R. Greenough.	Reginald Howell.
Patrick H. Kirkaldy.	William Stevenson.
Herbert Jackson.	*Edward Bevan.*

Truelove, Charles William,

17, Tylney Road, Forest Gate, E.

Teacher. Student at East London College, 1904–1908. Student at Regent Street Polytechnic, 1907 to present time (engaged in Research Work). B.Sc. (Lond.). Desirous of keeping in touch with latest work in Chemistry.

J. T. Hewitt.	H. Stanley Redgrove.
Clarence Smith.	Frank E. Weston.
J. J. Fox.	*H. R. Ellis.*
H. Mansfield.	*W. H. Collier.*

Usher, Francis Lawry,

18, Clifton Park, Bristol.

Student. B.Sc. Lond. 1851 Exhibition Science Research Scholar, 1907–9. "Ueber die Löslichkeit von NO in wässerigen Lösungen von $FeSO_4$,$NiSO_4$,$CoSO_4$ and $MnCl_2$," *Zs. f. physik. Chem.*, **62** (1908), 622. Joint author of following: "On the Interaction of Arsenic Acid with Hydrogen Sulphide in presence of Hydrochloric Acid," *J.C.S., Trans.*, **87** (1905), 1370. "On the Behaviour of Certain Substances at their Critical Temperatures," *Proc. Roy. Soc.*, **78**, *A*, 247. "The Mechanism of Carbon Assimilation in Green Plants," *Proc. Roy. Soc.*, (1906), **77**, *B*, 369. "The Mechanism of Carbon Assimilation in Green Plants: the Photolytic Decomposition of Carbon Dioxide *in vitro*," *Proc. Roy. Soc.*, **78**, *B*, 318 (1906).

William Ramsay.	A. W. Stewart.
N. T. M. Wilsmore.	R. W. Gray.
Edward C. Cyril Baly.	

Walker, George Bilderbeck,

"Vale House," Trafalgar Road, Greenwich, S.E.

Pharmacist to the Greenwich Infirmary. Chemist. Member of the Pharmaceutical Society. Performs Analytical Work for the Greenwich Board of Guardians. Desirous of keeping in touch with the progress of Chemical Science and Research.

Arthur J. Dickinson.	*W. R. Hodgkinson.*
Hermann C. T. Gardner.	*O. Aubrey Elias.*
Arthur H. Coote.	*Clement T. Rutter.*

Webster, John,

44, Holmewood Gardens, Brixton Hill, S.W.

Analytical Chemist. Studied Chemistry at Mason Univ. College, B'ham, under Prof. Percy F. Frankland. Assisted the late Sir Thos. Stevenson at Guy's Hospital (1901–1908). (Temporary) Public Analyst for the Boro' of St. Pancras (Aug.–Oct. 1908). Fellow of the Institute of Chemistry. Demonstrator in Pathological Chemistry and Assistant Chemical Pathologist at St. Mary's Hospital, W. (at the present time).

Arthur P. Luff.	George Senter.
W. H. Willcox.	R. Bodmer.
G. Roche Lynch.	

Wilson, Robert William,

2, Parade, Aldersbrook Road, Manor Park, E.

Lecturer on Chemistry, Technical College, East Ham. Board of Education Certificates, Stage III, Inorganic and Organic. Have carried out Research work with A. E. Dunstan, B.Sc. on (1) "Viscosity of Liquid Mixtures—H_2SO_4 and H_2O"; (2) "Viscosity of Fuming Sulphuric Acid," *Trans.*, 1907 and 1908. At present engaged in Research on "The Existence of Double Salt Complexes in Solution."

W. H. Barker.	George Young.
A. E. Dunstan.	T. P. Hilditch.
C. Schlienger.	

The following Certificate has been authorised for presentation to Ballot by the Council under Bye-law I (3):

Bletcher, Henry Ernest John,
Winnipeg, Manitoba.

Professor of Chemistry. Have been for eighteen years a student and teacher of Chemistry, and for the past nine years have been Professor of Chemistry in the Manitoba College of Pharmacy, which is affiliated with the University of Manitoba.

Matthew A. Parker.	*G. G. Henderson.*
E. B. Shuttleworth.	*William S. Denham.*

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 14/5/09

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 25. No. 356.

Thursday, May 6th, 1909, at 8.30 p.m., Professor Harold B. Dixon, F.R.S., President, in the Chair.

Messrs. H. C. Duckworth and I. H. Zortman were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Harold Edward Annett, B.Sc., Imperial Research Institute, Pusa, Behar, Bengal, India.
Harold Arnfield, Peak Lodge, Buxton Road, Stockport.
Alfred Charles Glyn Egerton, B.Sc., Chilton House, Thame, Oxon.
Harry Essex, jun., 23, Bescot Street, Walsall.
Andrew Sneddon Matchet, 13, Bute Gardens, Cathcart, N.B.
Norman Picton, B.Sc., Ph.D., 4, Pembroke Square, Kensington, W.
Herbert Charles Resker, B.A., The Sugar Works, Cossipore, Calcutta, India.
Barth. Frere Sawbridge, B.A., Thelnetham Rectory, Diss, Norfolk.
Harry Sampson Wills, 59, Caldecott Road, Denmark Hill, S.E.
George James Woods, 2, Wellmeadow Road, Lewisham, S.E.

A Ballot for the election of Fellows was held, and the following were subsequently declared duly elected:

Hugh Garner Bennett, M.Sc.
Albert Riley Blackburn, B.Sc.
Henry Ernest John Bletcher.
Frank Playfair Burt, B.Sc.
Walter Campbell.
Howard Alfred Caulkin, B.Sc.
John Henry Chew.
George Clarke.

Reginald Cyril Herbert Cooke.
George Stanley Cooper.
Daniel Little Couch.
Edward Gordon Couzens, B.Sc.
Henry Jermain Maude Creighton, M.A.
Philip Henry Crewe.
Francis Clifford Dyche-Teague, B.Sc.
William Fowler.
Charles James Grist.
Egerton Hargreaves, M.Sc.
John Frederick Haws.
Reginald Vernon Hickinbotham.
Reginald Hopkinson, B.Sc.
Leonard Angelo Levy, B.A., B.Sc.
Harry Livsey.
Floyd J. Metzger.
Robert Müller.
Frederick Leigh Okell.
Robert Cecil Owen, B.Sc.
Norman Scott Rudolf, M.Sc.
Henry Llewellyn Smith, B.Sc.
Arthur Percy Strohmenger.
Arthur Edwin Tate.
Oswald John Dalgatty Thomas.
Vernon James Tilley.
Charles William Truelove, B.Sc.
Francis Lawry Usher, B.Sc.
George Bilderbeck Walker.
John Webster.
Robert William Wilson.

Of the following papers, those marked * were read :

*115. "The absorption spectra of the nitrates in relation to the ionic theory." By Edward Charles Cyril Baly, Katharine Alice Burke, and Effie Gwendoline Marsden.

The absorption spectra have been examined of nitric acid and lithium, ammonium, and silver nitrates dissolved in alcohol and in water and in various mixtures of these solvents. A comparison between the persistencies of the absorption band shown by $N/10$-solutions of lithium and ammonium nitrates shows that considerable variations occur as the percentage of water in the solvent is increased. For example, when the solvent contains 3 per cent. of water a great decrease in the persistence of the absorption band is obtained as compared with that observed in pure alcohol and in alcohol containing 10 per cent. of water. On the other hand, the electrical conductivities of the $N/10$-solutions do not show any such variations, but only a steady increase with increase of water in the solvent. If, however, the limiting conductivities of the solutions be observed, it is found that a minimum is obtained when the solvent contains 3 per cent. of water. Nitric acid differs from the metallic nitrates in that it shows no absorption band and possesses very small electrical conductivity in pure alcoholic solution. The absorption band is developed, however, and the conductivity greatly increased with addition of water to the solvent. The limiting conductivity of the nitric acid solutions also shows a minimum with 3 per cent. of water in the solvent. The results afford strong support to the theory of hydrated ions, the decrease in limiting conductivity and the absorption band observed with the solvent containing 3 per cent. of water being doubtless due to the hydration taking place.

DISCUSSION.

Dr. SENTER asked if there was any evidence of a connexion between the viscosity of the (mixed) solvent and the limiting molecular conductivity of the salts (compare Walden, *Zeitsch. physikal. Chem.*, 1906, **55**, 217).

Mr. BALY said that the viscosity of the solvent seemed to exert only a very small influence. A mixture of alcohol and water in equal proportions showed a maximum viscosity, and although there was a minimum in the limiting conductivity of lithium nitrate near this point, neither silver nitrate nor ammonium nitrate showed any such minimum.

*116. "Studies in the camphane series. Part XXVI. Aryl derivatives of iminocamphor." By Martin Onslow Forster and Tom Thornley.

By condensing camphorquinone with aniline and some of its derivatives, aryliminocamphors have been obtained and are found to possess unusually high specific and molecular rotatory power. Reduction of these compounds leads to the corresponding derivatives of aminocamphor, and is accompanied by profound depression of optical activity.

DISCUSSION.

Mr. P. W. ROBERTSON asked whether the coloured compound investigated dissolved with different intensities in different solvents, and if so, whether any relationship had been observed between the intensity of colour and the magnitude of the specific rotation.

*117. "Substituted dihydrobenzenes. Part III. The so-called 1 : 1-dimethyl-$\Delta^{2:5}$-*cyclo*hexadiene of Harries and Antoni." By Arthur William Crossley and Nora Renouf.

It was shown that the hydrocarbon described by Harries and Antoni (*Annalen*, 1903, **328**, 88) as 1 : 1-dimethyl-$\Delta^{2:5}$-*cyclo*hexadiene is in reality a mixture of the *cyclo*hexadienes with the two methyl groups in the 1 : 2- and 1 : 3-positions, and probably does not contain any 1 : 1-dimethyl*cyclo*hexadiene.

*118. "Diethoxythioxan; a relation between the refractive power and chemical activity of some sulphur compounds." By Hans Thacher Clarke and Samuel Smiles.

The interaction of sodium sulphide and chloroacetal in alcoholic solution furnishes acetal sulphide, which, on treatment with mineral acid, yields the cyclic sulphide, *diethoxythioxan*. The reactivity of the sulphur in the latter compound has been qualitatively studied, and it is found to be abnormally low in comparison with that of the same element in acetal sulphide, benzyl sulphide, or saturated aliphatic sulphides. The authors consider that this depressed activity cannot be satisfactorily explained by steric hindrance, and, instead, offer the hypothesis that the residual affinities of the unsaturated cyclic sulphur and oxygen partly saturate one another. A similar explanation may be applied to other compounds containing bivalent sulphur of abnormally low activity, for example, thiophen and phenyl sulphide. The refractivity of these sulphur compounds also has been studied, and it was shown that a subnormal reactivity is accompanied by abnormal refractive power. The thioxan derivative appears to possess a slight optical anomaly.

DISCUSSION.

Dr. SMILES, in reply to Mr. Baly, stated that attempts made with the object of preparing a hydrochloride of diethoxythioxan had been unsuccessful. No indications of the substance having the structure of a hydroxytetrahydrothiophen, as suggested by Dr. Forster, had been found, since acyl derivatives were unobtainable.

In reply to the President's question as to the action of oxidising agents, hydrogen dioxide was without action, but hot concentrated nitric acid destroyed the substance, sulphuric acid being formed.

119. "The affinity constants of hydroxy- and alkyloxy-acids." By Alexander Findlay, William Ernest Stephen Turner, and Gertrude Emily Owen.

The affinity constants of phenylmethoxy-, phenylethoxy-, and phenylpropoxy-acetic acids and of α- and β-hydroxy-β-phenylpropionic acids have been determined at 25°. The values of the constant $100k$ were found equal to 0·074, 0·053, 0·048, 0·019, and 0·0040 respectively.

120. "The chlorination of acetanilide."

By William Jacob Jones and Kennedy Joseph Previté Orton.

When chlorinated by bleaching powder solution in acetic acid solution, acetanilide is converted into a mixture of *o*- and *p*-chloroacetanilides, of which the ortho-compound forms about 45 per cent., and not, as believed heretofore, less than 10 per cent. If the concentration of the acetic acid is less than 2 per cent., acetylchloroaminobenzene is formed together with the two chloroacetanilides ; when the acetic acid is diluted to 0·25 per cent., the chloroamine forms the chief product.

The transformation of the acetylchloroaminobenzene yields a mixture of the isomeric chloroacetanilides in the same proportion. Chlorination of acetanilide by chlorine in glacial acetic acid solution gives a mixture of the two anilides, in which 30 to 32 per cent. of the ortho-derivative is present.

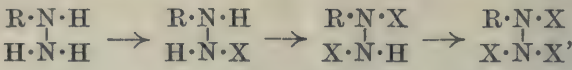
121. "Esterification constants of substituted acrylic acids. Part IV." By John Joseph Sudborough and Morton James Pryce Davies.

The constants, $E^{15°}_{MeOH}$, have been determined for the following acids: Acrylic, crotonic, α-methylacrylic, ββ-dimethylacrylic, angelic, tiglic, trimethylacrylic, *iso*butyric, α-methylbutyric, *iso*valeric, αβ-dimethylbutyric. The results indicate the retarding effect of the methyl groups and also establish the retarding effect of the double linking in the αβ-position. The most remarkable point is that ββ-dimethylacrylic acid is esterified less readily than α-methylacrylic acid or tiglic acid.

122. "The action of the halogens on aromatic hydrazines." By Frederick Daniel Chattaway.

From the behaviour of the primary aromatic hydrazines when oxidised, it seemed likely that evidence of the formation of the mono-*N*-halogen substituted derivatives, which should be the first products of the interaction of primary aromatic hydrazines and any halogen, would be obtained if the reactions were carried out in presence of alkalis. Such compounds in presence of alkalis would be unstable, and might be expected to decompose into nitrogen, halogen hydride, and hydrocarbons. *N*-Dihalogen substituted derivatives, corresponding with the halogen acid additive products of diazonium salts, might be formed in small amount under favourable conditions and similarly decompose, yielding a monohalogen-substituted hydrocarbon. These expectations have been completely realised. When chlorine or bromine is brought into contact with a primary aromatic hydrazine in presence of potassium or sodium hydroxide, very vigorous action takes place, nitrogen is freely evolved, and the $\cdot NH \cdot NH_2$ group is replaced by hydrogen; for example, by the action of bromine on phenylhydrazine, *p*-bromophenylhydrazine, *o*-tolylhydrazine, and *p*-tolylhydrazine, there are produced benzene, *p*-bromobenzene, and toluene respectively. Any theory which attempts to explain the action of the halogens on primary aromatic hydrazines must therefore account for the production of hydrocarbons, mono-, di-, tri-, and tetra-substituted hydrocarbons, azo-derivatives, azoimides, hydrocarbons of the diphenyl series, diazonium salts substituted and unsubstituted in the aromatic nucleus, and the so-called diazonium perbromides.

It was explained how the complicated changes, which result in the formation of so many substances of such very different constitutions, all depend on a progressive substitution of hydrogen attached to the nitrogen, thus:



$$\begin{array}{c}R\cdot N\cdot H\\ |\\ H\cdot N\cdot H\end{array} \rightarrow \begin{array}{c}R\cdot N\cdot H\\ |\\ H\cdot N\cdot X\end{array} \rightarrow \begin{array}{c}R\cdot N\cdot X\\ |\\ X\cdot N\cdot H\end{array} \rightarrow \begin{array}{c}R\cdot N\cdot X\\ |\\ X\cdot N\cdot X'\end{array}$$

followed by a breaking down or intramolecular rearrangement of the *N*-halogen-substituted hydrazines thereby produced.

123. "The retarding effect of oxygen on the rate of interaction of chlorine and hydrogen." By David Leonard Chapman and Patrick Sarsfield MacMahon.

The authors have shown that when a moist mixture of chlorine and hydrogen containing a known amount of oxygen is exposed to light of constant intensity, the rate of formation of hydrogen chloride is, to a first approximation, inversely proportional to the amount of oxygen present. It is concluded from this result that the sensitiveness of a mixture of chlorine and hydrogen from which all oxygen had been removed would be infinite. The above quantitative relation was shown to be in harmony with the theory of inhibition advanced by Burgess and Chapman (*Trans.*, 1906, **89**, 1433).

124. "The colour of aqueous solutions of violuric acid." By Frederick George Donnan and Wilhelm Schneider.

Experiments were described which show that the conclusion of W. N. Hartley (*Trans.*, 1905, **87**, 1797), that pure aqueous solutions of violuric acid are colourless, is erroneous.

125. "An examination of irritant woods. Part I. Chloroxylonine from East Indian satinwood." By Samuel James Manson Auld.

From East Indian satinwood, derived from *Chloroxylon swietenia*, which has been reported to possess irritant properties, have been separated calcium oxalate, a peculiar protein compound, two inert resins, a fixed oil, and an alkaloid, $C_{22}H_{23}O_7N$. As the alkaloid cannot be identified with any known base, it is proposed to call it *chloroxylonine*.

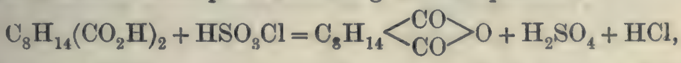
Chloroxylonine is a weak monoacidic base, and several of its salts have been prepared and characterised. It melts at 182—183°, contains four methoxyl groups, and is lævorotatory ($[\alpha]^{18}_{D}$ $-9°18'$). The physiological action of chloroxylonine is being investigated by Prof. Cash, of Aberdeen, and in certain circumstances it seems capable of causing dermatitis similar to that ascribed to the wood itself.

126. "Diazohydroxylamino-compounds and the influence of substituting groups on the stability of their molecules. Part II." By Norman Leslie Gebhard and Herbert Bryan Thompson.

The various diazohydroxylamino-compounds, prepared as described in the previous paper (*Trans.*, 1909, **95**, 767), have been examined with a view to determine the influence, due to position in the molecule, which the various substituting groups have on the stability of the compound considered. The action of bromine dissolved in an organic solvent, besides being a decomposing one, is of a substituting nature, and consequently of little use in determining the object in view; several new diazohydroxylamino-compounds were, however, prepared by its means. The action of hydrochloric acid in an organic solvent under comparable conditions for the various series of isomeric substitution products was also investigated; it was found that the nitro-, bromo-, and carbethoxy-groups (but not the methyl group), when present in the ortho-position, greatly increased the stability, but as soon as the substituting group entered the meta- or para-positions the stability of the molecule decreased enormously.

127. "A new method of preparing camphoric anhydride." By John Percy Edgerton.

When camphoric acid is treated with chlorosulphonic acid a vigorous reaction takes place according to the equation:



$$C_8H_{14}(CO_2H)_2 + HSO_3Cl = C_8H_{14}{<}{\substack{CO\\CO}}{>}O + H_2SO_4 + HCl,$$

the principal product being camphoric anhydride, which can be quickly prepared as follows: One hundred grams of finely powdered camphoric acid are placed in a capacious flask fitted with a drying tube containing calcium chloride, and 33 c.c. of chlorosulphonic acid are added; the mixture is then warmed on the water-bath, a further quantity of 16·5 c.c. of chlorosulphonic acid is added, and the whole again warmed for about half an hour until the evolution of gas has practically ceased. The mass is then mixed with water, filtered through glass wool, and washed until free from acid. The camphoric anhydride crystallises from methylated spirit in fine needles, which, if not quite pure, can be obtained pure by a second crystallisation.

128. "The action of phosphorus pentachloride on benzamide." By Arthur Walsh Titherley and Elizabeth Worrall.

In the action of phosphorus pentachloride on benzamide different results are obtained according to whether the action takes place (1) in the cold without a solvent, or (2) in the cold with a solvent, or at 50° with or without a solvent. In (1) the result appears to be a mixture of phosphoryl chloride and α-chlorobenzimide, $C_6H_5\cdot CCl{:}NH$, which gradually passes into benzonitrile and could not be isolated; in (2) αα-dichlorobenzylphosphamic chloride, $C_6H_5\cdot CCl_2\cdot NH\cdot POCl_2$, is formed, which immediately loses hydrogen chloride, yielding *α-chlorobenzylidenephosphamic chloride*, $C_6H_5\cdot CCl{:}N\cdot POCl_2$, as an oil which solidified at low temperatures. The latter compound is comparatively stable at 50°, but decomposes at higher temperatures into benzonitrile and phosphoryl chloride; on exposure to atmospheric moisture, it yields fine transparent crystals of *benzoylphosphamic chloride*,

$$C_6H_5\cdot C(OH){:}N\cdot POCl_2 \rightleftharpoons C_6H_5\cdot CO\cdot NH\cdot POCl_2$$

(m. p. 115°), which is practically unaffected by cold water. By treatment with aniline, α-chlorobenzylidenephosphamic chloride yields *phenyliminophosphorylphenylbenzamidine*, $C_6H_5\cdot C(NHPh){:}N\cdot PO{:}NPh$ (m. p. 227—228°).

Benzoylphosphamic chloride on treatment with aniline yields *phenyliminophosphorylbenzamide*,

$$C_6H_5\cdot CO\cdot NH\cdot PO{:}NPh \rightleftharpoons C_6H_5\cdot C(OH){:}N\cdot PO{:}NPh$$

(m. p. 226°), which is soluble in sodium hydroxide, or *benzoylaminoanilinophosphoryl chloride*, $C_6H_5\cdot CO\cdot NH\cdot POCl\cdot NHPh$ (m. p. 176°), according to the conditions of the reaction. The latter compound passes into the former by treatment with aniline, and does not yield the expected dianilino-derivative.

Benzoylphosphamic chloride readily undergoes replacement of the two chlorine atoms by hydroxyl on treatment with water in acetone solution, yielding *benzoylphosphamic acid*, $C_6H_5\cdot CO\cdot NH\cdot PO(OH)_2$ (m. p. 157—158°), which is readily soluble in water, and forms salts. The acid is rapidly decomposed by water at 100°, yielding phosphoric acid and benzamide, which crystallises out on cooling.

129. "Estimation of iron by permanganate in the presence of hydrogen chloride." By John Albert Newton Friend.

The author draws attention to the fact that the rate at which the permanganate is added to the ferrous solution greatly affects the value of the titration. It is suggested that the reaction takes place in two stages. First, a partial reduction resulting in the oxidation of some of the iron, and the formation of an unstable perchloride of manganese. The latter substance then oxidises the ferrous iron according to the equation:

$$MnCl_{(x+2)} + xFeCl_2 \rightarrow MnCl_2 + xFeCl_3$$

until equilibrium is established.

If the directions given are rigidly adhered to, fairly accurate estimations of iron may be obtained in the presence of *N*/4-hydrochloric acid.

130. "Contributions to the chemistry of the terpenes. Part V. The action of chromyl chloride on terpinene and on limonene." By George Gerald Henderson and William Cameron.

When chromyl chloride (2 mols.), largely diluted with carbon disulphide, is added to a similar solution of terpinene (1 mol.), a brown solid is formed which is decomposed by water, yielding a solution of chromic chloride and a brown, oily liquid. The liquid oxidation product contains small quantities of cymene and of a *ketone* of the formula $C_9H_{12}O$, but is mainly composed of *a*-*p*-tolylpropaldehyde, $C_6H_4Me{\cdot}CHMe{\cdot}CHO$, and *p*-tolyl methyl ketone, $COMe{\cdot}C_6H_4Me$, both of which are derivatives of cymene. Hence the behaviour of terpinene towards chromyl chloride is different from that of pinene and of camphene, for whilst each of the latter hydrocarbons yields an additive product, $C_{10}H_{16},2CrO_2Cl_2$, terpinene, on the other hand, is for the most part first oxidised to cymene, which then forms the compound $C_{10}H_{14},2CrO_2Cl_2$, from which the aldehyde and the ketone are produced by the action of water.

It has also been found that the aldehyde and the ketone formerly prepared from limonene in a similar manner (*Trans.*, 1907, **91**, 1871) are largely composed of *a*-*p*-tolylpropaldehyde and *p*-tolyl methyl ketone respectively, and therefore that limonene must likewise undergo at least partial oxidation to cymene when attacked by chromyl chloride under the conditions described.

131. "The influence of solvents on the rotation of optically active compounds. Part XV. Mixed solvents." By Thomas Stewart Patterson and Harvey Hugh Montgomerie.

The influence of two pairs of solvents on the rotation of an active compound was described, and the results were discussed in connexion with the heat of mixture of the various compounds concerned, and also with reference to the discrimination of compounds in solutions.

132. "Optically active reduced naphthoic acids. Part IV. Comparison of the rotatory powers of the di- and tetra-hydronaphthoic acids with those of phenylallylacetic, α-phenylvaleric, β-phenyl-α-ethyl- and β-phenyl-α-methyl-propionic acids." By Robert Howson Pickard and Joseph Yates.

A description was given of the resolution of five racemic acids by the fractional crystallisation of their *l*-menthylamine salts. The principal experimental results are recorded in the following table:

	Acid.					Menthylamine salt.	
Dextro-rotatory acids.	M. p.	$[M]_D$ at 20°.	$[M]_D$ in $CHCl_3$.	$[M]_D$ in C_6H_6.	$[M]_D$ of sodium salt in H_2O.	M. p.	$[M]_D$ in ethyl alcohol.
Δ^3-Dihydro-2-naphthoic ...	101°	—	+276·2°	+317·0°	+309·0°	143—144°	+251·6°
Phenylallyl-acetic	below 10°	—	148·9	181·6	40·2	145	−2·7
α-Phenylvaleric	,,	+128·3	104·7	140·7	5·0	141	−58·4
β-Phenyl-α-ethylpropionic	,,	—	68·3	73·0	100·7	137	−22·3
β-Phenyl-α methylpropionic	,,	37·1	45·5	44·4	66·8	143	+54·6

133. "The influence of hydroxy- and alkyloxy-groups on the velocity of saponification. Part II." By Alexander Findlay and Evelyn Marion Hickmans.

The velocities of saponification of ethyl glycollate, lactate, α-hydroxy-β-phenylpropionate, γ-hydroxy-γ-phenylbutyrate, phenylpropionate, propionate, β-hydroxy-β-phenylpropionate, and of methyl phenylacetate have been determined. The values of the saponification constant obtained for these esters were 75, 63·5, 40·1, 16·5, 6·9, 5·3, 4·9, 27·4 respectively. From these numbers it is found that the introduction of a phenyl group accelerates the velocity of saponification, except when the ester contains the hydroxyl group. In this case, introduction of a phenyl group lowers the velocity of saponification (for example, ethyl mandelate and ethyl glycollate). Introduction of an hydroxyl group increases the saponification constant to nearly twelve times its value in the case of esters not containing the phenyl group, but to only five to six times its value in the case of phenylated esters. A comparison of the saponification constants of the ethyl esters with the affinity constants of the corresponding acids shows that there is no general relationship between the two magnitudes.

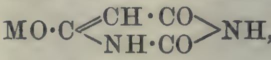
134. "Apparatus for experiments at high temperatures and pressures, and its application to the study of carbon. (A correction)." By Richard Threlfall.

The author recently described an experiment (*Trans.*, 1908, **93**, 1333) in which graphite was forced through a narrow tube by a comparatively small pressure—negligible in comparison with the pressures under which the property of the fluidity of graphite was employed to transmit pressure. The experiment there described can be repeated as often as desired, but the inference that pressure can be transmitted in all circumstances without any appreciable loss of head by crystalline graphite is wrong. Further experience has shown that when graphite flows it does not obey the laws regulating the flow of liquids, but that the fluidity of graphite is a function of the absolute pressure to which it is exposed. Under high pressures the graphite consolidates, and in this state transmits pressure very badly. For instance, in the experiment described (*loc. cit.*), it is now known that rapid flow took place under a pressure of a few hundred pounds per square inch—the graphite flowing freely into the air. When, however, the graphite, otherwise under similar conditions, was employed to force a pointed piston of hard steel against a soft steel plate, and pressures of 50 to 100 tons per square inch were employed for the purpose, a loss of head of many tons per square inch was found. The observation was made by measuring the depth to which the pointed piston entered the steel plate, and then causing it to penetrate to the same depth by direct pressure. In most of the experiments described in the paper referred to, the graphite flowed into a bath of molten magnesia through a very short neck of unmelted tube, and consequently the experimental results quoted are probably little or not at all affected by the error involved in supposing that graphite, when it flows, obeys the ordinary laws of flow of liquids. Some preliminary experiments indicate that cold lead flowing under high pressure is much more truly a fluid than crystalline graphite.

135. "Experiments on the constitution of the aloins. Part I." By Robert Robinson and John Lionel Simonsen.

The authors communicated the results of some further experiments on the nature of rhein, a preliminary note of which has already appeared (*Proc.*, 1909, **26**, 76).

136. "The constitution of the salts of barbituric acid." By John Kerfoot Wood and Emma Alexander Anderson.

The authors have shown that by the action of acetic anhydride on a mixture of carbamide and malonic acid, *ureidomalonamide* is formed, together with barbituric acid and an apparently complex substance, the constitution of which has not been established. Ureidomalonamide is a white, very sparingly soluble substance, which, on treatment with sodium hydroxide, is converted into sodium barbiturate. This action shows that the constitution of the salts of barbituric acid is represented by the general formula  $\mathrm{MO{\cdot}C}\Big\langle\begin{matrix}\mathrm{CH\cdot CO}\\ \mathrm{NH\cdot CO}\end{matrix}\Big\rangle\mathrm{NH}$, where M is a univalent metal. Theoretical considerations leading to a similar conclusion were also discussed.

137. "The estimation of carbonates in presence of nitrites, sulphides or sulphites by means of potassium dichromate." By Ernest Robert Marle.

It was proved that soluble carbonates and carbonates of bases which form soluble chromates are quantitatively decomposed by aqueous potassium dichromate. The action of potassium dichromate on nitrites has been investigated. On distillation with dichromate, a nitrite yields nitrous acid, although the mixed solution apparently contains no free nitrous acid. The yield of nitrous acid increases with the concentration of the nitrite, but is almost independent of that of the dichromate.

Prolonged distillation, either adding water at the rate at which the liquid distils, or making the solution up to its original volume after, say, 100 c.c. has distilled over, gives 60—70 per cent. of the nitrite as nitrous acid. The residual nitrite in the flask is estimated, and the loss of 10—15 per cent. is accounted for by the decomposition of nitrous acid into nitric acid and nitric oxide, some of the nitric oxide remaining dissolved in the dichromate solution.

An apparatus was described with which carbonates can be estimated in the presence of nitrites, the mixture being distilled with dichromate under reflux. The carbon dioxide is thus freed from nitrous acid, and the nitric oxide formed is negligible. The method is found to give accurate results.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Clowes, *Frank,* and **Coleman,** *J. Bernard.* Elementary practical chemistry. Part II. Analytical chemistry. 6th edition. pp. xv + 241. ill. London 1909. (*Recd.* 7/4/09.)
From the Publishers: Messrs. J. & A. Churchill.

Keane, *Charles Alexander.* Modern organic chemistry. pp. xv + 503. ill. London 1909. (*Recd.* 15/4/09.) From the Author.

Mees, *C. E. Kenneth.* The photography of coloured objects. pp. vi + 69. ill. Croydon 1909. (*Recd.* 15/4/09.)
From the Author.

Miller, *Wilhelm von,* und **Kiliani,** *Heinrich.* Kurzes Lehrbuch der analytischen Chemie. 6th edition. pp. xi + 643. ill. München 1909. (*Recd.* 14/4/09.) From Professor H. Kiliani.

Parry, *L.* Systematic treatment of metalliferous waste. pp. 121. London [1909]. (*Recd.* 17/4/09.)
From the Publisher: *The Mining Journal.*

Sudborough, *John Joseph,* and **James,** *T. Campbell.* Practical organic chemistry. pp. xviii + 378. ill. London 1909. (*Recd.* 16/4/09.) From the Publishers: Messrs. Blackie & Son.

II. *By Purchase.*

Calmette, *A.* Recherches sur l'épuration biologique et chimique des eaux d'égout. Vols. 3 & 4. pp. v + 274, iv + 214. ill. Paris 1908–09. (*Recd.* 24/4/09.)

Rupe, *Hans.* Die Chemie der natürlichen Farbstoffe. Teil II. (Bolley's *Handbuch,* 61.) pp. ix + 236. Braunschweig 1909. (*Recd.* 31/3/09.)

Witt, *Otto N.,* and **Lehmann,** *Ludwig.* Chemische Technologie der Gespinnstfasern. Lieferung 4. (Bolley's *Handbuch,* 67.) pp. 577—770. Braunschweig 1909. (*Recd.* 31/3/09.)

Wright, *Herbert.* Hevea Brasiliensis, or Para rubber: Its botany, cultivation, chemistry and diseases. 3rd edition. pp. xvii + 204. ill. Colombo 1908. (*Recd.* 27/4/09.)

Wurtz, *Adolf.* Abhandlung über die Glycole oder zweiatomige Alkohole und über das Aethylenoxyd als Bindeglied zwischen organischer und Mineralchemie. Aus dem Französischen übersetzt und mit Anmerkungen versehen von *M.* u. *A.* **Ladenburg.** (Ostwald's *Klassiker,* No. 170.) pp. 96. Leipzig 1909. (*Recd.* 24/4/09.)

III. *Pamphlets.*

Bein, *W.* Zur Ausdehnung des Aethylaethers und einiger Mischungen des aethers mit Aethylalkohol. (From the *Abhandl. K. Normal-Eichungskom,* 1908, **7**.)

Dezani, *Serafino.* Le basi proteiche contenute nello sperma e nelle ovaie del tonno ed i loro prodotti idrolitici. (From the *Giorn. R. Accad. Med. Torino,* 1908, **14**.)

Fermor, *L. Leigh.* Note on a group of Manganates, comprising Hollandite, Psilomelane, and Coronadite. (From the *Records, Geol. Survey of India,* 1908, **36**.)

Fischer, *H. W.* Untersuchungen über Metallhydroxyde. pp. 80. Breslau 1907.

Grünwald, *Hermann Friedrich.* Ueber die Lebenswichtigkeit der Chloride für den Organismus. (From the *Zentr. Physiol.,* 1908, **22**.)

Strauss, *Eduard.* Notiz zum Nachweis des Urobilins im Harn. (From the *Münch. med. Woch.,* 1908.)

WOLCOTT GIBBS MEMORIAL LECTURE.

The above lecture will be delivered by Professor Frank Wigglesworth Clarke at the Ordinary Scientific Meeting on Thursday, June 3rd, at 8.30 p.m.

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in June next. Applications for Grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, June 7th, 1909.

All persons who received grants in June, 1908, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Tuesday, June 1st.

The Council wish to draw special attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

At the next Ordinary Meeting on **Thursday**, May **20th**, 1909, at **8.30** p.m., the following papers will be communicated:

"The action of nitric acid on the ethers of aromatic hydroxyaldehydes." By A. H. Salway.

"Isolation and synthesis of *p*-hydroxyphenylethylamine, a water-soluble active principle of ergot." By G. Barger.

"Nitrodi-*o*-xylyl. (Nitrotetramethyldiphenyl.) Preliminary note." By A. W. Crossley and C. H. Hampshire.

"Ammonium perhalides." By F. D. Chattaway.

"Studies in asymmetric synthesis. Part VIII. The asymmetric synthesis of *l*-mandelic acid." By A. McKenzie and H. B. P. Humphries.

"Note on the condensation of acetone and hippuric acid." By W. H. Perkin and J. L. Simonsen.

"Sodium sulphite." By H. Hartley and W. H. Barrett.

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Issued 29/5/09

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 25. No. 357.

Thursday, May 20th, 1909, at 8.30 p.m., Sir JAMES DEWAR, F.R.S., Past-President, in the Chair.

Messrs. F. P. Burt, R. C. H. Cooke, G. S. Cooper, and F. L. Usher were formally admitted Fellows of the Society.

The CHAIRMAN announced that the Council had voted the sum of £10 towards the International Memorial now being organised to commemorate the contributions of Amedeo Avogadro to chemical and and physical science.

It was stated also that the Society have become indebted to the Society of Dyers and Colourists for a bronze reproduction of a plaque by Mr. F. W. Pomeroy, R.A., representing the late Sir William Perkin.

Certificates were read for the first time in favour of Messrs. :—

John Gunning Moore Dunlop, St. Helen's, Holywood, Belfast.
Oswald Farquhar Kirby, M.A., B.Sc., 14,. Wellclose Mount, Leeds.
Fred Robinson, B.A., B.Sc., Broadway, Skerton, Lancaster.

Of the following papers, those marked * were read :

*138. "Thio-oxalates." (Preliminary note).

By Humphrey Owen Jones and Hubert Sanderson Tasker.

The esters of dithio-oxalic acid are readily prepared by the action of alkyl hydrosulphides on oxalyl chloride; the dimethyl, diethyl, and diphenyl esters are crystalline, and show a distinct yellow colour (the diphenyl compound is a bright sulphur-yellow).

These esters are decomposed by hot potassium hydroxide solutions into potassium oxalate and alkyl hydrosulphide, but when heated with a concentrated alcoholic solution of potassium hydrosulphide a white solid separated, which was found to be *potassium dithio-oxalate*, $(KSCO)_2$. This salt is white and crystalline, and is very soluble in water, giving a yellow solution, from which it separates in colourless prisms when evaporated on the water-bath. The salt gives intense colours with solutions of certain metallic salts, and precipitates with others; some of these precipitates decompose on heating, yielding the sulphide of the metal. The most striking reactions are those given with solutions of nickel and cobalt salts, the former give an intense magenta colour, the latter a deep brown colour, in both cases so intense as to be visible in solutions containing one part of the metal in 8,000,000 parts of solution.

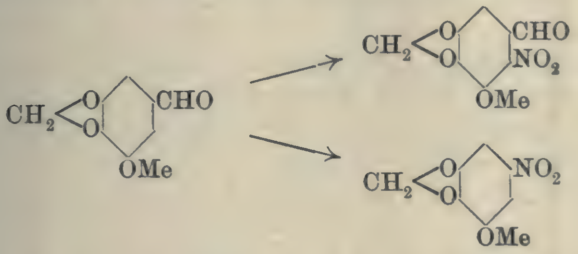
The coloured compound formed with nickel can readily be obtained in small, black, lustrous needles, resembling small crystals of potassium permanganate; these were found to have the composition required by the formula $C_4O_4S_4K_2Ni$. Solutions of this salt and the cobalt salt are stable to acids, and the metals are only precipitated very slowly from them by the addition of potassium hydrosulphide or hydroxide.

Potassium monothio-oxalate is prepared by the action of alcoholic potassium hydrosulphide on diethyl monothio-oxalate, $(COSEt{\cdot}CO_2Et)$, and separates slowly in white needles, which contain one molecule of water of crystallisation. This salt is also very soluble in water, but gives a colourless solution; the solution decomposes on addition of acid, and gives colours and precipitates with metallic salts which are very similar to those given by the dithio-oxalate, but the insoluble salts are in this case more readily decomposed.

The corresponding acids are unstable, and have not yet been isolated in the pure state.

*139. "The action of nitric acid on the ethers of aromatic hydroxyaldehydes." By Arthur Henry Salway.

The author has shown that when myristicinaldehyde is acted on by nitric acid (sp. gr. 1·41) at 0°, part of the aldehyde is directly nitrated, whilst the remainder undergoes nitration with the elimination of the aldehyde group, the products of the reaction being nitromyristicinaldehyde and 5-nitro-1-methoxy-2:3-methylenedioxybenzene. It was also shown, by determining the position of the nitro-group, that the formation of the latter compound is due to the direct substitution of the aldehyde group by the nitro-group. The action of nitric acid on myristicinaldehyde is represented, therefore, as follows:



On investigating the action of nitric acid on piperonal, vanillin methyl ether, and anisaldehyde, it was found that the above transformation is common to the ethers of aromatic hydroxyaldehydes, and that the accumulation of oxyalkyl groups in the molecule enhances the readiness with which the aldehyde group is eliminated on nitration.

DISCUSSION.

Dr. MORGAN remarked that the author's hypothesis of the formation of an additive compound with aldehyde and nitric acid preceding the replacement of the aldehyde group by nitroxyl is confirmed by the fact that aldehydes and ketones both furnish nitrates which may often be obtained crystalline. Camphor nitrate has long been known, and benzaldehyde nitrate has recently been isolated (D.R.-P. 206695 and *Abstr.*, 1909, i, 238).

*140. "Some physical properties of radium emanation." By Robert Whytlaw Gray and Sir William Ramsay, K.C.B.

The atomic weights of the inactive gases are: helium, 4; neon, 20; argon, 40; krypton, 83, and xenon, 131. The differences are respectively 16, 20, 43, and 48. Differences of 44 × 2 are to be found between the atomic weights of antimony and bismuth, and of barium and radium; it is therefore to be expected that the element following xenon in the periodic table should have the atomic weight 175; the subsequent element, 219; and possibly an element of still higher atomic weight, 263. The emanation from radium has been condensed to a liquid; its vapour pressures have been determined in a modified Andrew's apparatus, and the volume of the liquid has also been measured. The boiling point under atmospheric pressure is −62°; the critical temperature is 104·5°, and the critical pressure is 47,450 mm. If these numbers are mapped on segments of circles on which the corresponding constants for argon, krypton, and xenon lie, they intersect the ordinate of atomic weights at the figure 176. That appears to decide the atomic weight of the emanation; for if it be assumed as 219, the form of the curve would have to be completely altered, and, indeed, would become reflex. From another standpoint, the boiling point, with atomic weight 219, would be 49 degrees higher, and the critical point 53 degrees higher, than the points where the atomic weight ordinates cut these curves.

DISCUSSION.

Sir WILLIAM RAMSAY added the following particulars to Dr. Gray's description of the results of their experiments: The volume of the emanation, calculated for 0° and 760 mm. pressure, is 0·6 cub. mm. per gram of radium in radioactive equilibrium; this confirms Rutherford's measurements. The sudden diminution of the volume of the emanation, remarked by himself and Soddy, again with Cameron, and by Rutherford, is due in all probability to the absorption of the foreign gas by the walls of the containing vessel under the influence of the emanation. It has been observed, too, that emanation also enters the walls of the tube. In Mr. Usher's experiments with ammonia, hydrogen disappeared, and was subsequently recovered from the broken-up tube by heating it in a vacuum.

*141. "Isolation and synthesis of *p*-hydroxyphenylethylamine, an active principle of ergot soluble in water." By George Barger.

The isolation of *p*-hydroxyphenylethylamine,

$$OH{\cdot}C_6H_4{\cdot}CH_2{\cdot}CH_2{\cdot}NH_2,$$

from aqueous ergot extracts, and the synthesis of this physiologically active principle by the reduction of *p*-hydroxyphenylacetonitrile, were described.

*142. "Nitrotetramethyldiphenyl." (Preliminary note.)

By Arthur William Crossley and Charles Herbert Hampshire.

When fuming nitric acid is gradually added to *o*-xylene, there are obtained unchanged *o*-xylene, mononitro-*o*-xylenes, and a *nitrotetramethyldiphenyl*, $C_{16}H_{17}O_2N$ (*Trans.*, 1909, **95**, 217), crystallising from alcohol in clusters of stout, yellow, flattened needles, melting at 115°.

That the two benzene nuclei in this substance are linked together by carbon atoms of the nuclei and not by those of the methyl groups is proved by oxidation with dilute nitric acid, when a *nitrotetracarb-*

oxylic acid, $C_{12}H_5O_2N(CO_2H)_4$, is produced. It crystallises from water with $1H_2O$ in small, white clusters of hair-like needles, melting and evolving gas at 225°. The *tetraethyl* ester, $C_{12}H_5O_2N(CO_2Et)_4$, crystallises from alcohol in almost colourless, transparent, irregular needles, melting at 126—127°.

Nitrotetramethyldiphenyl is reduced by tin and hydrochloric acid to *aminotetramethyldiphenyl*, which separates from light petroleum in radiating clusters of transparent needles, melting at 81°.

Experiments are now in progress with the object of definitely establishing the exact positions of the various groups in this nitrotetramethyldiphenyl.

143. "Ammonium perhalides." By Frederick Daniel Chattaway.

The author has recently (*Proc.*, 1908, **24**, 172) expressed the view that the diazonium trihalides are *N*-trihalogen derivatives of the hydrazines. In order to compare their properties with those of the ammonium perhalides, the latter have been prepared and their behaviours studied. Only ammonium perbromide, ammonium periodide, and ammonium dibromoiodide have apparently been previously isolated. The supposed risk of explosion from liberation of nitrogen chloride appears to have hindered attempts to prepare the perhalides containing chlorine. Two of these compounds have now been prepared, and prove to be remarkably stable substances. *Ammonium dichloroiodide*, $NH_4{\cdot}Cl_2I$, crystallises in large, brilliant scarlet prisms, and *ammonium chlorobromoiodide*, $NH_4{\cdot}ClBrI$, in large, brilliant garnet-red prisms. Both can be kept in closed vessels for a long period without apparent change. When heated they do not explode, but lose two atoms of halogen, pure ammonium chloride being left. Both are extremely soluble in water, and deliquesce in damp air.

A study of the properties of the ammonium perhalides shows that they and the diazonium perhalides cannot be regarded as analogously constituted. For example, diazobenzene perbromide is a solid insoluble in water which can be preserved in a vacuum over lime for a long period with very slight loss in weight. Ammonium perbromide, on the other hand, is extraordinarily easily soluble in water, and loses two-thirds of its bromine if exposed for a few minutes in the air.

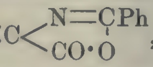
A large number of perhalides of primary amines have been prepared; these closely resemble the ammonium perhalides in properties.

144. "Studies in asymmetric synthesis. Part VIII. The asymmetric synthesis of *l*-mandelic acid." By Alex. McKenzie and Herbert Brooke Perren Humphries.

The authors described the asymmetric synthesis of *l*-mandelic acid. *l*-Menthyl benzoylformate was reduced by aluminium amalgam, the reduction product acetylated, and a lævorotatory mandelic acid mixture obtained by hydrolysis of the reduction product and subsequent complete elimination of the active menthol.

The isomeric *l*-menthyl acetylmandelates have also been investigated.

145. "Note on the condensation of acetone and hippuric acid." By William Henry Perkin, jun., and John Lionel Simonsen.

Hippuric acid and acetone readily condense in the presence of acetic anhydride and sodium acetate with formation of the *anhydride* of *a-benzoylamino-β-dimethylacrylic acid*,  $CMe_2{:}C{<}\begin{matrix}N{=}CPh\\ CO\cdot O\end{matrix}$, which crystallises from dilute alcohol in almost colourless needles, m. p. 98—99°. When hydrolysed with alkalis or cold hydrochloric acid, it is converted into *a-benzoylamino-β-dimethylacrylic acid*, $CMe_2{:}C(NH\cdot COPh)\cdot CO_2H$, which separates from ethyl acetate in glistening needles decomposing at 217°. This acid, when heated with concentrated hydrochloric acid, is decomposed into benzoic acid and *dimethylpyruvic acid*,

$$CHMe_2\cdot CO\cdot CO_2H.$$

Dimethylpyruvic acid, which has not previously been obtained in a pure state, solidifies, when cooled, to thin leaflets melting at about 16°, and boils at 133—135°/200 mm. It yields an *oxime* decomposing at 161°, a *semicarbazone* decomposing at 176°, and a *hydrazone* decomposing at 152° (not 129° as stated by Brunner, *Monatsh.*, 1895, **15**, 763). Its *ethyl* ester boils at 173°/764 mm.

The authors wish to reserve this acid for further investigation.

146. "The physical properties of aqueous sodium sulphite." By Harold Hartley and William Henry Barrett.

In a systematic examination of the system sodium sulphite–water, the solubility of the two stable forms $Na_2SO_3,7H_2O$ and Na_2SO_3 has been determined, and a transition temperature has been found in the neighbourhood of 22°. The conditions under which either the hydrated modification or ice separates from a supersaturated solution have been studied; the extent of the metastable region in the former case amounts to as much as 30°. The crystallographic properties of the anhydrous salt have also been examined.

147. "The preparation of disulphides. Part V. Diethyl esters of α-dithiodibutyric, α-dithiodi*iso*butyric, and α-dithiodi*iso*valeric acids." By Thomas Slater Price and Douglas Frank Twiss.

In continuation of previous work the *diethyl* esters of *α-dithiodibutyric*, *α-dithiodi*iso*butyric* and *α-dithiodi*iso*valeric acids* have been prepared by the electrolytic reduction of the mixtures obtained by the interaction of sodium thiosulphate with ethyl α-bromobutyrate, ethyl α-bromo*iso*butyrate, and ethyl α-bromo*iso*valerate respectively. These esters are all liquids heavier than water and distil unchanged under diminished pressure; the boiling points are as follows: diethyl α-dithiodibutyrate, 187°/22 mm.; diethyl α-dithiodi*iso*butyrate, 166°/19 mm.; diethyl α-dithiodi*iso*valerate, 173°/12 mm.

From these esters only *α-dithiodi*iso*butyric* acid could be prepared in a pure state; it is a solid, melting at 197—198°.

148. "Relation between chemical constitution and physiological action in the tropeines. Part II." By Hooper Albert Dickinson Jowett and Frank Lee Pyman.

In continuation of former work on the subject, the authors have prepared and submitted to physiological examination a large number of tropeines, many of which had not been previously described. The physiological results indicated that the so-called Ladenburg's generalisation (which is not due to Ladenburg) cannot be strictly applied.

149. "The formation of silicates, glasses, and glazes." By John W. Cobb.

On the assumption that a glass can be regarded as formed by the combination and solution of its constituent oxides, the author has studied the process of formation of the glass represented by the formula $Na_2O,CaO,Al_2O_3,10SiO_2$.

An investigation on the combination of lime and silica shows that the compounds formed are $2CaO,SiO_2$ and CaO,SiO_2.

Lime and alumina interact to form the compounds CaO,Al_2O_3,

$CaO,2Al_2O_3$, and an insoluble calcium aluminate, presumably containing a large amount of alumina.

The general question of chemical interaction between solids was discussed, and the conclusion was drawn that: (1) the temperature of formation of a slag and its fusion point are not identical, nor are they apparently related (in opposition to Boudouard's generalisation); (2) interaction between solids may go far, even to completion, without fusion; (3) from 800° upwards the state of mixed solid particles is one of fairly effective molecular contact, allowing free play to selective chemical affinities.

150. "The determination of the rate of decomposition of benzenediazonium chloride." By Francis Edward Everard Lamplough.

Some further experiments* have been made on the decomposition of benzene diazonium chloride, and direct measurements of the amount of nitrogen stored up in the solution have been obtained. When rather more than ordinary care is taken to keep the vessels and solutions free from dust and impurities, degrees of supersaturation up to 300 times the normal amount of gas dissolved have been observed.

Further experiments with direct measurement of temperature have confirmed the values of the constants previously obtained for the reaction (*Trans. Camb. Phil. Soc.*, 1908, **14**, 590).

151. "Acids as accelerators in acetylation." Part II.

By Alice Emily Smith and Kennedy Joseph Previté Orton.

The speed of acetylation of *s*-tribromophenol in the presence of sulphuric, perchloric, and orthophosphoric acids has been measured. Whereas in acetic acid and chloroform solution, acetic anhydride has no perceptible action on *s*-tribromophenol at the ordinary temperature, even after keeping for several weeks, in the presence of perchloric and sulphuric acids, acetylation takes place very rapidly. Orthophosphoric acid (or phosphoric oxide) comes far behind as an accelerator. When the quantity of acid is small, the rate of the reaction is approximately proportional to its concentration. Comparing gram-molecular proportions, perchloric acid is about 2·5 times as effective as sulphuric acid.

Chloroform is the medium in which acetylation is the most rapid, but acetic acid is only slightly inferior. Benzene and acetone are unfavourable to acetylation.

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* Compare *Trans. Camb. Phil. Soc.*, 1908, **14**, 580; *Proc.*, 1909, **25**, 24.

A comparison of pyridine, acids, and sodium acetate as accelerators of acetylation by acetic anhydride, shows that both the two former are far superior. Pyridine is approximately as effective as perchloric acid and therefore superior to sulphuric acid.

152. "Resolution of racemic alcohols." (Preliminary note.) By Robert Howson Pickard and Joseph Kenyon.

Pickard and Littlebury have recently described (*Trans.*, 1907, **91**, 1973) a method for the complete resolution of racemic alcohols by the fractional crystallisation of salts formed by acid esters of the alcohol with optically active bases. By this method they obtained the pure borneols and *iso*borneols, and have synthesised *l*-menthol from thymol (*Proc.*, 1908, **24**, 217).

The present authors in a similar way (*Trans.*, 1907, **91**, 2058) carried out the first successful resolution of an aliphatic alcohol, namely, that of octane-2-ol with $[\alpha]_D^{17} \pm 9{\cdot}9°$, and in view of work recently published abroad, wish to state that in conjunction with several collaborators they are engaged in applying the method to alcohols of very varied types.

Among the secondary alcohols already resolved (the specific rotatory power, $[\alpha]_D^{17}$, being given in brackets) are: butane-2-ol ($+13{\cdot}3°$); pentane-2-ol ($+14{\cdot}3°$); hexane-2-ol ($+11{\cdot}6°$); nonane-3-ol ($\pm 8{\cdot}0°$); phenylmethylcarbinol ($+32{\cdot}8°$), and phenylethylcarbinol ($\pm 27{\cdot}3°$).

153. "Syntheses with phenol derivatives containing a mobile nitro-group. Part II. The interaction of 2:3:5-trinitro-4-acetylaminophenol and amines" (continued). By Raphael Meldola and James Gordon Hay.

In continuation of former researches (*Trans.*, 1906, **89**, 1935; 1908, **93**, 1659) the authors have studied the formation of iminazoles and other compounds quantitatively from the point of view of steric hindrance. The protective influence of substituents in the ortho-position is brought out very clearly in the recorded results. With the hydroxyl or methoxy-group in the para-position, some protecting influence is also exerted, the yields in the case of *p*-aminophenol and *p*-anisidine being less than with the corresponding meta-compounds. The general results obtained with the six series of isomeric substituted amines, namely, the chloroanilines, bromoanilines, nitroanilines, aminophenols, anisidines, and aminobenzoic acids, have been classified in the order of yield and compared with the results obtained by

Wedekind with picryl chloride. Experiments with the trinitro-compound and secondary amines have revealed the remarkable fact that catenation takes place only with dimethylamine and piperidine. All the homologues of dimethylamine, from diethylamine to di*iso*-amylamine, are without action. This fact has led the authors to suggest an extension of the hypothesis of steric hindrance to cases in which a mobile atom or radicle is protected on both sides by ortho-substituents, and in which the actual size of the radicles carried by the reacting compound determines the possibility of catenation.

All the new iminazoles and *m*-aminophenol derivatives prepared in the course of the research were described and characterised.

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in June next. Applications for Grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, June 7th, 1909.

All persons who received grants in June, 1908, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Tuesday, June 1st.

The Council wish to draw special attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

At the next Ordinary Meeting on **Thursday**, June **3rd**, 1909, at **8.30** p.m., Professor Frank Wigglesworth Clarke will deliver the Wolcott Gibbs Memorial Lecture, and the following papers will be communicated :

"The molecular weight of tetraethylammonium bromide and the atomic weight of carbon." By A. Scott.

"The rate of formation of azo-derivatives from benzenoid diamines." By V. H. Veley.

"The synthesis of substances allied to cotarnine." By A. H. Salway.

"Monomethylfructose and its derivatives. Constitution of fructosediacetone." By J. C. Irvine and A. Hynd.

"On optically active δ-oximino-hexahydrobenzoic acid and the configuration of the oximino-group." (Preliminary note.) By W. H. Mills and Miss A. M. Bain.

R CLAY AND SONS, LTD., BREAD STREET HILL, E.C., AND BUNGAY, SUFFOLK

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PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 25. No. 358.

Thursday, June 3rd, 1909, at 8.30 p.m., Professor HAROLD B. DIXON, F.R.S., President, in the Chair.

Certificates were read for the first time in favour of Messrs.:

Hardee Chambliss, Ph.D., 56, W. 36th Street, New York City, U.S.A.
Edward Walter Taplin, Church House, Heavitree, Exeter.

A certificate has been authorised by the Council for presentation to ballot under Bye-Law I, par. 3, in favour of Dr. Hassum A. Lakhani, Murud Janjira, India.

Professor FRANK WIGGLESWORTH CLARKE, of Washington, then delivered the Wolcott Gibbs Memorial Lecture, at the conclusion of which Professor Sir JAMES DEWAR moved a vote of thanks to Professor Clarke.

Professor THORPE, in seconding the motion, congratulated the Society in securing in their Honorary Foreign Member, Prof. Clarke, one so eminently capable of doing justice to the signal services which his deceased countryman, the late Dr. Wolcott Gibbs, had rendered to chemical science. The Chemical Society justly prided itself on the distinction conferred upon it by the distinguished men who constituted the class of its Honorary Members. They honoured them living, and when death summoned them from the scene of their activities, they sought to honour them dead, and by lectures such as they had heard to-night to commemorate their achievements and to indicate their relation and true position towards the science which they had laboured to advance. In putting together the story of Dr. Wolcott Gibbs' life and work, Dr. Clarke had enjoyed the advantage of contact and intimate personal acquaintance with his subject, and it was this personal note which rendered his discourse specially interesting and valuable.

Professor OTTO N. WITT expressed his great satisfaction at having been able to listen to Professor Clarke's lecture, which not only deserved the greatest praise for its literary and scientific merits, but had also a great personal interest for himself.

In the German Chemical Society it was customary for the death of prominent members to be announced by the president in the meeting following the sad event, and a short biographical sketch had to be given on such occasions, pending the publication of an elaborate essay at the end of the year. Thus it had been his (the speaker's) duty to give an account of the life and labours of Wolcott Gibbs in one of the meetings of the Society. In compiling the necessary notes, he had observed how scant the existing information was, and the short time at his disposal had not allowed him to ask Professor Clarke for a few notes as he would like to have done. There were a few things, however, which made it quite certain that Gibbs, who was an honorary member of the German Chemical Society as well as of the English one, had been deserving of the greatest esteem. It was quite evident that he had enjoyed the sincere friendship of the great founder of the German Society, A. W. Hofmann, whose name was also a household word amongst English chemists. And it was equally certain that Gibbs possessed great merits as a teacher and as the head of the brilliant and successful school of American chemists, of which Professor Clarke, whom the speaker had learned to know and to admire during his stay in the United States, was the most distinguished representative. Whilst supporting the motion for a vote of thanks to Professor Clarke, he begged to thank the President for having given him this opportunity for paying a tribute of personal admiration both to the memory of Wolcott Gibbs and to Professor Clarke, who had pictured the life and the work of his dead master in words that had come from the depth of his heart.

Professor CHARLES BASKERVILLE said that the honour paid him by the President in asking him to support the vote of thanks proposed by Sir James Dewar was, he knew, intended as a personal one. He was endeavouring to fill the Chair, the third in line, first occupied by the distinguished lamented subject of Dr. Clarke's eloquent eulogy. He wished, however, to emphasise something more significant. As mentioned by the lecturer, Wolcott Gibbs was the founder of the

Union League Club of New York, which organisation sought to preserve the Union. His (the speaker's) father and all his relations sought to dismember that Union for reasons they thought good. The Union was happily preserved, however, and a scion of the Confederate States was now carrying forward the educational work inaugurated by the deceased patriot. Chemistry thus showed itself in a social way as the crucible of civilisation.

It gave him peculiar personal pleasure to support the motion for another reason unknown to many of those present. Professor Clarke was his chemical grandfather, for he taught Professor Dudley, who was also present, and who in turn had taught him (the speaker). His pride in the delightfully charming manner in which Dr. Clarke, the pupil, had shown his appreciation of his former master could therefore well be understood.

The PRESIDENT said that, in its Memorial Lectures, he thought the Chemical Society had learnt to look for three excellences.

They wished in the first place to have recorded the main steps in the career of the distinguished chemist whom they were met to commemorate, so that they might appreciate the difficulties he faced and how he surmounted them—difficulties which could only be made real to them by one who was a past master of their science; secondly, they looked for some personal and sympathetic touches to tell a younger generation what kind of man was he who was gone; and lastly, they were delighted when the story was told them, not only scientifically and sympathetically—but with that arrangement and perspective and charm of language which could turn even chemistry into literature.

They could congratulate themselves that in all these excellences the lecture of Prof. Clarke fulfilled, and more than fulfilled, their ideals.

The vote of thanks was put to the meeting, carried by acclamation, and acknowledged by Professor CLARKE.

Of the following papers, those marked * were read:

*154. "The molecular weight of tetraethylammonium bromide and the atomic weight of carbon." By Alexander Scott.

The author gave an account of his endeavours to determine the molecular weight of a hydrocarbon with a degree of accuracy comparable to that attained in the determination of the atomic weights of many elements. This has been done for C_8H_{16} by titrating pure tetraethylammonium bromide against pure silver, after the manner of Stas. To precipitate 107·93 parts of silver, 210·324 parts of

$N(C_2H_5)_4Br$ were required, whilst for the same weight of silver 97·995 parts of ammonium bromide were necessary. Subtracting

$$\begin{array}{lrcl} \text{from} & 210{\cdot}324 & = & NC_8H_{20}Br \\ & 97{\cdot}995 & = & N\ \ H_4\ Br. \\ \hline \text{we obtain} & 112{\cdot}329 & = & C_8H_{16} \end{array}$$

If we take $H = 1{\cdot}0075$, then $H_{16} = 16{\cdot}12$, which gives $112{\cdot}329 - 16{\cdot}120 = 96{\cdot}209 = C_8$ or $C = 12{\cdot}026$.

This number has been corroborated by a titration made in the same way of a small quantity of tetramethylammonium bromide, which gave $154{\cdot}150 = N(CH_3)_4Br$, and, similarly, 56·155 for C_4H_8 and $C = 12{\cdot}024$. Taking 107·88 as the atomic weight of silver, we get $C = 12{\cdot}018$.

DISCUSSION.

Professor F. W. CLARKE called attention to the fact that the new value proposed for the atomic weight of carbon was notably higher than that found by recent investigators with physical methods. From the densities of carbon dioxide, carbon monoxide, and methane, the atomic weight of carbon was very near 12. In Lenher's determinations of the atomic weight of tellurium, a value had just been found of 127·33, calculated with the international figures for silver, potassium, chlorine, and bromine of several years ago. This result was lower than the best results obtained by others. But on recalculating Lenher's work with the new value for the other atomic weights, the value for tellurium was 127·55, in close agreement with former determinations. Hence, the discrepancy was due, not to the work done, but to the antecedent factors used in calculation. How far the discordance in the figures for carbon might be due to similar causes it was too soon to say, but part of it was thus to be explained.

Sir W. RAMSAY called attention to the possibility of included mother liquor in the ammonium bromide and the tetraethylammonium bromide.

In reply, Dr. SCOTT pointed out that the methods employed in precipitating and drying the various specimens of the salt, as well as the very close agreement of the results, seemed to exclude all probability of the dried salt containing any mother liquor. The atomic weight taken for silver (107·93) rendered the results more readily comparable with those of Stas, whilst the value 107·88 at present adopted by the International Committee, as Dr. Thorpe had pointed out, was probably only of transient interest and might, by further research, be still further lowered.

155. "The rate of formation of azo-derivatives from benzenoid diamines." By Victor Herbert Veley.

It was shown that (i) the rate of formation, as studied by a tintometer method, of azo-compounds from benzenoid diamine hydrochlorides and sodium nitrite is conditioned by the hydrochloric acid and monohydrochloride liberated by hydrolysis. It is an example of a simultaneous linear reaction expressed simply as $\Delta x/\Delta t = k$.

(ii) The total amount of dyestuff capable of being formed, or range, is a linear function of concentration, but the increase of rate is a logarithmic function of the concentration expressed as $\log k_n = \log k_1 + a \log c$ (c = concentration, a = constant to be evaluated from the results).

(iii) The rate is a logarithmic function of absolute temperature according to the expression $k_1/k = (T_1/T)^m$.

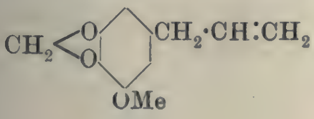
(iv) The addition of hydrochloric and other acids produces an initial acceleration, but a total retardation, the reaction sooner coming to an end, and consequently the amount of dyestuff capable of being formed is thereby diminished.

(v) The substitution of hydrogen by the methyl grouping (comparison of phenylene- and tolylene-diamine—Bismarck Brown and Vesuvine) causes a slight decrease in rate, but a considerable decrease in the total amount of dyestuff capable of being formed.

It is considered probable that this is a result of the more ready decomposition of the intermediate diazo-compound in the case of the latter than in that of the former.

156. "The synthesis of substances allied to cotarnine." By Arthur Henry Salway.

The material employed as the starting point in this investigation was myristicin (3-methoxy-4 : 5-methylenedioxy-1-allylbenzene), which was obtained from the essential oil of nutmeg (compare Power and Salway, *Trans.*, 1907, **91**, 2037). The successive stages in the synthesis are represented by the following compounds : (I) myristicin, (II) *iso*myristicin, (III) myristicinaldehyde, (IV) nitromyristicinaldehyde, (V) nitromethoxymethylenedioxycinnamic acid, (VI) ketomethoxymethylenedioxydihydroquinoline, (VII) ketomethoxymethylenedioxymethyldihydroquinoline, and (VIII) oxy*iso*cotarnine.



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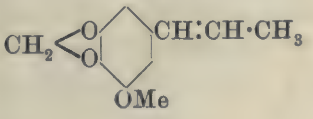

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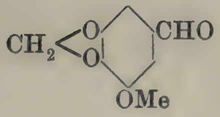

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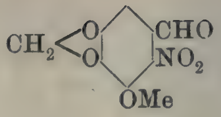

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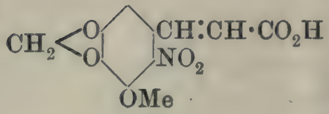

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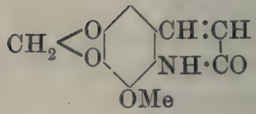

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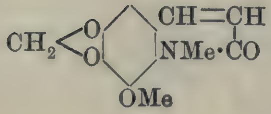

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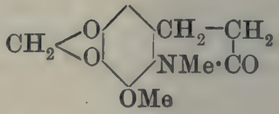


(VIII.)

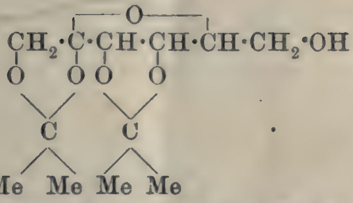
Ketomethoxymethylenedioxydihydroquinoline, ketomethoxymethylenedioxymethyldihydroquinoline, and oxy*iso*cotarnine are closely related to cotarnine, and their physiological action is at present under investigation.

An account was also given of several attempts to synthesise cotarnine, which, however, were unsuccessful.

157. "Monomethyl lævulose and its derivatives. Constitution of lævulosediacetone." By James Colquhoun Irvine and Alexander Hynd.

Lævulosediacetone yields on methylation by the silver oxide reaction a crystalline derivative (*monomethyl α-laevulosediacetone*), melting at 115°, and having $[\alpha]_D^{20}$ $-136{\cdot}4°$ in methyl-alcoholic solution. The compound is very easily hydrolysed by dilute acids to give *monomethyl laevulose*, which is apparently the first definite example of a mono-substituted sugar other than the glucosides or the metallic derivatives. The sugar crystallises from ethyl acetate in the pure α-form, which displays mutarotation in the downward sense: $[\alpha]_D^{20}$ $-70{\cdot}5° \longrightarrow -53{\cdot}1°$. On the other hand, fusion gives an excess of the β-form, and the reverse optical change ensues on solution. The compound yielded *monomethylglucosazone* as yellow needles, melting at 142°, and was oxidised by bromine water to *αβ-dihydroxy-γ-methoxybutyric acid.*

These results show that the methyl group in the alkylated ketose is in the δ-position with reference to the reducing group, and, according to this view, the structure of lævulosediacetone must be



In addition, it has been shown that the alkylated sugar condenses readily with acetone or with methyl alcohol, and the products thus obtained are interconvertible under suitable conditions. The specific rotations of the various compounds described show that the total optical effect resulting from complete methylation of the sugar molecule is the additive sum of oppositely directed values.

158. "Optically active 4-oximino*cyclo*hexanecarboxylic acid and the configuration of the oximino-group." (Preliminary note.) By William Hobson Mills and Alice Mary Bain.

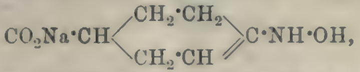
When a sufficiently dilute solution of equimolecular proportions of 4-oximino*cyclo*hexanecarboxylic acid (W. H. Perkin, *Trans.*, 1904, **85**, 427) (4·7 grams) and quinine (9·7 grams) in ethyl acetate is allowed to evaporate slowly at the ordinary temperature, a quinine salt crystallises in silky needles during the course of two or three days.

The salt thus obtained was recrystallised three times from ethyl acetate and then decomposed by suspending it in water, carefully adding a slight excess of dilute aqueous sodium hydroxide, and extracting repeatedly with ether to remove quinine. There was thus obtained a slightly alkaline solution of sodium salt, from which all quinine had been removed, corresponding with about 1·8 grams of oximino-acid. On polarimetric examination in a 2-dcm. tube, very distinct lævorotation was observed, namely, $\alpha_D' -4{\cdot}4^\circ$. The optical activity was immediately destroyed by acidification with dilute hydrochloric acid.

From the above observations, it appears probable that the sodium salt of 4-oximino*cyclo*hexanecarboxylic acid can exist in a dextro- and lævo-modification, as well as the inactive form corresponding with the acid described by Perkin.

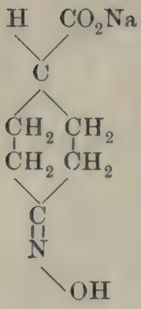
Since in a compound of this constitution enantiomorphism is possible only if the three valencies of the nitrogen atom of the oximino-group do not lie in one plane, the two active forms must correspond with the two configurations* :

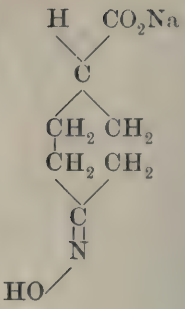
[*] An alternative constitution for the active salt,



$$CO_2Na{\cdot}CH\left\langle\begin{matrix}CH_2{\cdot}CH_2\\CH_2{\cdot}CH\end{matrix}\right\rangle C{\cdot}NH{\cdot}OH,$$

is very improbable, since acidification, which would be expected to favour the grouping :C·NH·OH relatively to C:NOH, at once destroys the activity.





The existence of an optically active form of this substance thus affords evidence of the validity of the fundamental hypothesis in the Hantzsch-Werner theory of the isomerism of the oximes. It is also of interest in connexion with the recent work on optically active substances which do not contain an asymmetric carbon atom in the narrower sense (Perkin and Pope, *Trans.*, 1908, **93**, 1075; Harding, Haworth, and Perkin, *ibid.*, 1943; Perkin, Pope, and Wallach, *Proc.*, 1909, **26**, 83; also Marckwald and Meth, *Ber.*, 1906, **39**, 1171, etc.).

The authors are proceeding with this investigation, and hope in due course to submit a complete account of their results.

159. "*cyclo*Butane-1 : 3-dicarboxylic acid and some of its derivatives." By William Henry Perkin, jun., and John Lionel Simonsen.

The authors described the action of hydrobromic acid and of bromine on *cyclo*butane-1 : 3-dicarboxylic acid and on norpinic acid, and discussed the conditions under which disruption of the *cyclo*butane ring takes place in these and analogous cases.

160. "The oxidation of mucic acid in presence of iron." By Frederic Ferraboschi.

The oxidation of mucic acid by means of hydrogen dioxide in presence of iron has been investigated. The principal product is a strongly reducing acid, which appears to be a *dihydroxymucic acid.* It may also be regarded as a diketonic acid, namely, *dihydroxydiketo-adipic acid.* Its *dihydrazone* has been prepared.

Parallel experiments on the oxidation of saccharic acid gave analogous results, but the products obtained are not identical with those derived from mucic acid.

161. "The production of ozone in the interaction between hydrogen dioxide and sulphur dioxide." (Preliminary note.) By Frederic Ferraboschi.

In an investigation of the well-known reaction between sulphur dioxide and hydrogen dioxide, it has been observed that ozone is produced in considerable quantities.

It is found that when sulphur dioxide is rapidly led into a solution of hydrogen dioxide (both "10 volume" and "20 volume" strengths were used), it is entirely destroyed in passing through a layer 2 or 3 cm. deep. Each bubble almost, but not entirely, disappears, and ozone is produced in quantities sufficient to be easily detected by its odour. Its presence may be further proved by its actions on starch-potassium-iodide paper, and on paper moistened with an acetic acid solution of *pp'*-tetramethyldiaminodiphenylmethane ("tetra-base").

The production of ozone can also be observed when excess of hydrogen dioxide is added to aqueous sulphurous acid.

The same effect is not produced in the reaction of hydrogen dioxide with sodium sulphite or thiosulphate, or when sodium or barium peroxides, either with or without an acid, are added to aqueous sulphurous acid.

The reaction is being examined quantitatively.

162. "The action of sulphur monochloride on salts of organic acids: a convenient method of preparing anhydrides." By William Smith Denham.

When sodium benzoate is boiled with a solution of sulphur monochloride in light petroleum, a compound of the probable formula $(C_6H_5{\cdot}CO_2S)_2$ is formed, which is very unstable and soon decomposes, giving sulphur, sulphur dioxide, and benzoic anhydride. The formation of this compound takes place more easily if the silver salt is used. Similar derivatives of acetic, propionic, phenylacetic, and the toluic acids have been obtained.

The easy formation and simple decomposition of these compounds suggests a method of preparing the anhydrides of the acids.

Sulphur monochloride reacts also with metallic derivatives of imides.

163. "The velocity of decomposition of nitroglycerin by heat." Part I. By Robert Robertson.

Nitroglycerin (glyceryl trinitrate) is heated in a current of carbon dioxide in an apparatus arranged to condense any volatilised nitroglycerin and, on rotation about an oblique axis, return it to be again heated. The nitrogen peroxide evolved is determined by Robertson and Napper's spectroscopic method (*Trans.*, 1907, **91**, 761). The products of decomposition are then passed over red-hot copper and copper oxide, and the nitrogen is measured over potassium hydroxide. It was found that nitroglycerin decomposes uniformly, yielding nitrogen peroxide, that the rate of decomposition is a function of the temperature, being doubled for every 5° between 95° and 125°, and that the rate of decomposition is higher than that of guncotton.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Baron, *Harold.* Chemical industry on the Continent. A report to the Electors of the Gartside Scholarships. pp. xi + 71. Manchester 1909. (*Recd.* 20/5/09.)

From the Publishers: Messrs. Sherratt & Hughes.

International Congress of Applied Chemistry, VII. *Explosives Section.* The rise and progress of the British explosives industry. pp. xiv + 418. ill. London 1909. (*Recd.* 25/5/09.)

From the Publishers: Messrs. Whittaker & Co.

Matthews, *J. Merritt.* Laboratory manual of dyeing and textile chemistry. pp. xii + 363. New York 1909. (*Recd.* 19/5/09.)

From the Publishers: Messrs. John Wiley & Sons.

Schimpf, *Henry W.* A manual of volumetric analysis for the use of pharmacists, sanitary and food chemists. 5th edition. pp. xx + 725. ill. New York 1909. (*Recd.* 19/5/09.)

From the Publishers: Messrs. John Wiley & Sons.

Stone, *C. H.* Practical testing of gas and gas meters. pp. x + 337. ill. New York 1909. (*Recd.* 19/5/09.)

From the Publishers: Messrs. John Wiley & Sons.

Zsigmondy, *Richard.* Colloids and the ultramicroscope. Authorized translations by *Jerome* **Alexander.** pp. xiii + 245. ill. New York 1909. (*Recd.* 19/5/09.)

From the Publishers: Messrs. John Wiley & Sons.

II. *By Purchase.*

Werner, *A.* Neuere Anschauungen auf dem Gebiete der anorganischen Chemie. pp. xv + 292. II Auflage. Braunschweig 1909. (*Recd.* 19/5/09.)

LIST OF FELLOWS, 1909.

The List of Fellows for 1909 is now in active preparation, and changes of address received after 31st July cannot be included in it.

In order that the new list may be as complete as possible, those Fellows whose degrees and Christian names do not appear in full are requested to communicate them to the Assistant Secretary.

At the next Ordinary Meeting on **Thursday**, June **17th**, 1909, at **8.30** p.m., there will be a ballot for the election of Fellows and the following papers will be communicated:

"The carbonate of copper and the cupricarbonates." By S. P. U. Pickering.

"*iso*Quinoline derivatives. Part I. Oxidation of laudanosine." By F. L. Pyman.

"The colour and constitution of azo-compounds." By J. T. Hewitt and W. Thomas.

"*iso*Iminazolone." By H. J. H. Fenton and W. A. R. Wilks.

"Homologues of furfural." By H. J. H. Fenton and F. Robinson.

"Studies of dynamic isomerism. Part IX. The relationship between absorption spectra and isomeric change. Absorption spectra of sulphonic derivatives of camphor." By T. M. Lowry and C. H. Desch.

"The relation between the strength of acids and bases and the quantitative distribution of affinity in the molecule." Part II. By B. Flürscheim.

"The oxidation of hydroxy-derivatives of benzaldehyde and acetophenone." By H. D. Dakin.

"The intramolecular rearrangement of diphenylamine orthosulphoxides." By E. de B. Barnett and S. Smiles.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, June 17th, 1909.

Annett, Harold Edward,

Imperial Research Institute, Pusa, Behar, Bengal, India.

Supernumerary Agricultural Chemist, at present acting as Imperial Agricultural Chemist in the Indian Agricultural Service, Imperial Department. 1. B.Sc. (Agriculture) of London University. 2. A member by Diploma of the South-Eastern Agric. College (Lond. Univ.) with Honours in Agricultural Chemistry. 3. Demonstrator in Chemistry and Analyst at above College, 1906–7. 4. Acted as Agricultural Chemist to the Government of Bombay, and lectured in Chemistry in the Poona Agricultural College, Aug.–Nov., 1908. 5. Author with Dr. E. J. Russell of "Composition of Green Maize and the Silage produced therefrom," *Journal Agricultural Science*, 1908, Vol. 2.

J. Walter Leather. M. J. R. Dunstan.
Robert S. Finlow. A. D. Hall.
E. J. Russell.

Arnfield, Harold,

Peak Lodge, Buxton Road, Stockport.

Pharmaceutical Chemist.

Arthur W. Crossley. Chas. Horne Warner.
Charles Gilling. *M. O. Forster.*
Alexander Scott.

Dunlop, John Gunning Moore,

St. Helen's, Holywood, Belfast, and Caius College, Cambridge.

Undergraduate. Scholar of Caius College, Cambridge. Collaborated with H. O. Jones in investigation of "Action of Ethylene Dibromide on Monomethyl Aniline" (*Trans.*, 1909, p. 416).

S. Ruhemann. H. J. H. Fenton.
H. O. Jones. W. J. Sell.
W. J. Pope.

Edge, John Harold,

Great Marld, Smithills, Bolton.

Technical Chemist. Works Chemist at Messrs. Wm. Edge & Sons, Ltd., Bolton. Studied Chemistry 4 years under Dr. Marshall, of Leighton Hall College; also at the Royal Technical Institute, Salford, and Manchester University. Anxious to keep in touch with the latest chemical research.

J. R. Appleyard. E. Clark.
B. Prentice. *J. Wertheimer.*
John S. Lumsden.

Egerton, Alfred Charles Glyn,

Chilton House, Thame, Oxfordshire.

Research student at present. B.Sc. (Chemistry Hons.), London, 1908. "Vapour Pressure of Bromine at Low Temperatures" (not yet published), and "Divergence of Atomic Weights from Whole Numbers" (*Trans.*, 1909, p. 238).

T. C. Porter. W. H. Gibson.
William Ramsay. R. W. Gray.
S. Smiles.

Essex, jun., Harry,

23, Bescot St., Walsall.

Blast-Furnace Chemist. Chief Chemist to Messrs. G. & R. Thomas, Bloxwich and Walsall; teacher of Practical and Theor. Metallurgy at Municipal Institute, Walsall; King's Prize, Stage III, Theor. Metallurgy, and Bronze and Silver Medals in Iron and Steel Manufacture, City and Guilds Institute. Certificates in Stages II and III Chemistry, B. of E.

Arthur Adams. Harry Silvester.
Frank E. Thompson. *J. B. Coleman.*
Wm. Oldershaw.

Hibbert, Harold,

"Creston," Marple Bridge, Derbyshire.

Research Chemist. Master of Science (Vict.); Ph.D. (Leipzig); F.I.C. Author or joint author of some twelve original publications dealing with organic chemistry, published in the *Transactions of the*

Chemical Soc., *Berichte der Deutsch. Chem. Gesellschaft*, and Liebig's *Annalen.*

Harold B. Dixon.
Wm. A. Bone.
Jocelyn F. Thorpe.
G. H. Bailey.
W. H. Perkin.

Kirby, Oswald Farquhar,

14, Wellclose Mount, Leeds.

Lecturer on Chemistry. Master of Arts (First Class Honours in Mental Science), Aberdeen University; Bachelor of Science (1st in Honours Class of Organic Chemistry, and 1st prizeman in Agricultural Chemistry, Theoretical and Practical), Aberdeen; Head of the Chemical Department, Modern School, Leeds; Lecturer in Organic Chemistry, Technical School, Leeds.

F. R. Japp.
James Hendrick.
T. S. Murray.
A. N. Meldrum.
James C. Philip.
F. W. Branson.

Matchet, Andrew Sneddon,

13, Bute Gardens, Cathcart.

Analytical Chemist. Chief Chemist, Scottish Wholesale Co-operative Society, Ltd., Shieldhall, Govan. Student with Messrs. R. R. Tatlock, City Analysts, Glasgow, for over 2 years.

R. R. Tatlock.
R. T. Thomson.
Harry Dunlop.
William S. Denham.
Thomas Gray.

May, Roland Josiah,

Granaugh Villa, Dunbar, Scotland.

Analytical Chemist to The British Malt Products Co., of London, Accrington, and Dunbar. Six years' tuition in Chemistry at the Central Foundation Schools of London. Student at the Northern Polytechnic and the Hackney Institute; 3 years Assistant to Leo. Taylor, F.I.C., Public Analyst for Hackney.

Edwin C. Jee.
Edwin M. Eagles.
E. Geo. Streimer.
Thomas H. Pope.
L. T. Thorne.
E. Haynes Jeffers.

Napier, Thomas,

Arbiene, Clarkston, Busby.

Analytical Chemist. Studied at the Glasgow Technical College, and have been employed by the Cassel Cyanide Co., Ltd., for eleven years.

Thos. Ewan.
J. H. Young.
G. G. Henderson.
Thomas Gray.
William S. Denham.

Picton, Norman,

4, Pembroke Square, Kensington, W.

Works Chemist. Ph.D. (Leipzig), B.Sc. (Wales); 1851 Exhibition Scholar, 1906–08. Joint author of "Influence of Substituents in the Trinitrobenzene Molecule on the Formation of Additive Compounds with Arylamines" (*Trans. Chem. Soc.*, 1906).

Henry E. Roscoe.	J. J. Sudborough.
P. Phillips Bedson.	T. Campbell James.

J. W. Dodgson.

Resker, Herbert Charles,

The Sugar Works, Cossipore, Calcutta, India.

Chemist and Assistant of Cossipore Sugar Works. Late Science Scholar of Corpus Christi College, Cambridge. Cambridge Natural Science Tripos, Part I, Class I; Part 2, Class 2. Assistant Demonstrator in Chemistry at the Cambridge University Laboratory, 1905–1908.

W. J. Sell.	H. O. Jones.
H. J. H. Fenton.	J. E. Purvis.

F. W. Dootson.

Robinson, Fred.,

Broadway, Skerton, Lancaster.

Now engaged in research at Cambridge University Chemical Laboratories. First Class Natural Sciences Tripos, Part I, 1907; 2nd ditto, ditto, Part II, 1908 (Chemistry). Second Class Honours (Chemistry) London B.Sc., 1908. Late Scholar and Prizeman of Peterhouse Cambridge. Assistant Demonstrator in Univ. Chemical Laboratories, Cambridge, 1908–1909.

W. J. Sell.	H. O. Jones.
H. J. H. Fenton.	J. E. Purvis.

F. W. Dootson.

Sawbridge, Barth. Frere,

Thelnetham Rectory, Diss, Norfolk.

Chemical Analyst. 2nd Class Final Honour School of Natural Science (Chemistry), 1906; Associate Institute of Chemistry; Assistant to A. C. Chapman, Esq., F.I.C., F.C.S.; Assistant Demonstrator in Bacteriology at Battersea Polytechnic.

Alf. Chaston Chapman.	W. W. Fisher.
F. Guy Stirling Baker.	G. W. Monier-Williams.

Fredk. T. Harry.

Wills, Harry Sampson,

59, Caldecott Road, Denmark Hill, S.E.

Analytical Chemist. Formerly Chemist in the Laboratories of Burgoyne, Burbidges & Co.; subsequently Analyst with Messrs. Lorimer & Co., and now Analytical and Research Chemist with the firm of Boilerine, Limited.

Albert E. Bell.	T. W. Firth Clark.
Thos. Farries.	*T. Pitt.*
Reginald G. Halstead.	*F. W. Brown.*
T. G. Joyce.	*J. Brierley.*

Woods, George James,

2, Wellmeadow Road, Lewisham, S.E.

Schoolmaster. I have been a student of Chemistry since 1900, and am at present working in the Laboratory of the Goldsmiths' College. Although at present reading for an Honours degree in Chemistry, I intend at the earliest opportunity to proceed to research work in the subject, and to take up the science as a profession. I am desirous of securing privileges which attach to the Fellowship of the Society.

E. Wechsler.	W. H. Ratcliffe.
R. W. L. Clarke.	*A. T. Larter.*
Arthur Lapworth.	*M. White Stevens.*

H. Harding.

The following Certificate has been authorised for presentation to Ballot by the Council under Bye-law I (3):

Lakhani, Hassum A., M.D.,

Murud-Janjira (Bombay Presidency, India).

Chief Medical Officer, Janjira State (India). Doctor of Medicine of the University of Brussels. Chief Medical Officer and Health Officer and Chief Chemical Analytical Officer of Janjira State. Has special interest in Chemical researches. Has prepared the fragrant oils and essences from Indian fragrant flowers.

I. B. Lyon.	*Albert Cooper.*

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 29/6/09

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 25. **No. 359.**

Thursday, June 17th, 1909, at 8.30 p.m., Professor Harold B. Dixon, F.R.S., President, in the Chair.

Messrs. W. L. Dudley, A. H. Elliott, and G. B. Walker were formally elected Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Benjamin Leech, M.A., Beech Knoll, Macclesfield.
Frederic William Robinson, B.Sc., Grove House, Farnworth, Widnes.
Prof. Dr. Hermann Thoms, Berlin, Steglitz, Hohenzollernstr. 3.
Everard Cecil Van Essen, 28, Hereford Road, Snaresbrook, N.E.

A Certificate has been authorised by the Council for presentation to Ballot under Bye-law I, par. 3, in favour of A. K. Yegna Narayan Aiyer, M.A., Bangalore, India.

A Ballot for the election of Fellows was held, and the following were subsequently declared duly elected:

Harold Edward Annett, B.Sc.
Harold Arnfield.
John Gunning Moore Dunlop.
John Harold Edge.
Alfred Charles Glyn Egerton, B.Sc.
Harry Essex, jun.
Harold Hibbert, M.Sc., Ph.D.
Oswald Farquhar Kirby, M.A., B.Sc.
Hassum A. Lakhani, M.D.
Andrew Sneddon Matchet.
Roland Josiah May.
Thomas Napier.
Norman Picton, B.Sc., Ph.D.
Herbert Charles Resker, B.A.
Fred. Robinson, B.A., B.Sc.
Barth. Frere Sawbridge, B.A.
Harry Sampson Wills.
George James Woods.

Of the following papers, those marked * were read:

*164. "The carbonates of copper and the cupricarbonates." By Spencer Umfreville Pickering.

Besides the mineral azurite, $3CuO,2CO_2,H_2O$, and the ordinary carbonate of copper, malachite, $2CuO,CO_2,H_2O$, the following carbonates have been isolated.

$5CuO,2CO_2$: a blue, bulky precipitate, obtained by the precipitation of copper salts by sodium carbonate. $5CuO,3CO_2$: a light blue, stable precipitate, obtained by precipitation with sodium hydrogen carbonate. $8CuO,3CO,6H_2O$: a rather dark blue substance, obtained by the action of water on the double carbonate of copper and sodium.

All the basic carbonates are insoluble in water and in sodium carbonate solution, but they dissolve slightly in aqueous carbonic acid and in acid carbonates, a normal copper carbonate, or a double carbonate of copper and the alkali metal, being formed. The latter is obtained as a molecular compound in rather light blue crystals from such solutions, although in the solutions it is present in another form, as sodio-cupric carbonate, of the constitution: $NaO\cdot CO\cdot OCuO\cdot CO\cdot NaO$. In this compound the copper is electro-positive, but has a colour thirty times more intense than the copper in copper sulphate. When excess of sodium carbonate is added to it, the copper becomes electro-negative, and has a colour eighty times more intense than that in copper sulphate. The substance then present is an α-cupricarbonate, consisting of $Na_2Cu(CO_3)_2$ united with Na_2CO_3, but in which the copper is joined to the carbon atoms, and is in a quadrivalent condition. It oxidises dextrose, and the constitution suggested represents the presence of a loosely combined oxygen atom explaining such a reaction. Excess of sodium hydroxide decomposes it, but a greater excess dissolves the precipitated basic carbonate to form a deep violet-blue solution of the β-cupricarbonate, which consists of $Na_2Cu(CO_3)_2$ united with 1 or 2NaOH. This, too, oxidises dextrose, and also combines with cellulose. It is stable in presence of excess of alkali, whereas the α-compound gradually decomposes, either into the crystalline double salt or into malachite. The sodio-cupric carbonate decomposes in a similar manner.

Discussion.

Mr. W. C. Reynolds expressed the opinion that although it was possible to give to the double carbonates the structural formula which the author had done, they did not afford a satisfactory explanation, since certain of the double succinates (*Trans.*, 1898, **73**, 703), which were exactly analogous, and exhibited the same behaviour in solution, had the composition $K_4R(C_4H_4O_4)_3$, where R is Cu or Co. Such compounds could not be formulated in the way described by the author, and it appeared probable that the constitution of the cupricarbonate could be explained by molecular association with water of crystallisation, thus involving the idea of quadrivalent oxygen.

Mr. W. A. Davis suggested that in assigning structures to the mixed or double carbonates, the water of crystallisation probably ought to be considered; he had previously shown that the so-called trihydrate of magnesium carbonate, $MgCO_3,3H_2O$, was in reality a hydrated hydroxy-carbonate, $OH\cdot MgCO_3H,2H_2O$ (*J. Soc. Chem. Ind.*, 1906, **25**, 788), and had ascribed the impossibility of preparing normal copper carbonate by precipitation to the great tendency to the formation of mixed alkali copper carbonates, the hydrolysis of which gave rise to basic carbonates. In the case of magnesium he had succeeded in giving a proof that the very numerous "basic carbonates" were really mixtures of three compounds, $OH\cdot MgCO_3H$,

$OH\cdot MgCO_3H,2H_2O$,

and $Mg(OH)_2$, in varying proportions. In the case of copper there was slender evidence as to the existence of definite basic carbonates other than malachite and azurite.

Mr. E. H. Jeffers asked if Mr. Pickering considered the formula given for the α-cupricarbonate was analogous to Fehling's blue salt, because in the latter the copper had been shown to be in the electropositive condition.

He was inclined to think that these compounds were simply molecular aggregates, in which the alkali hydroxide took the place of water of hydration. For instance, the corresponding citric acid compound was a peculiar peacock-green colour, easily reduced by sugar, but on addition of a little alkali hydroxide one obtained an intensely blue solution, exactly similar to Fehling's blue salt.

Moreover, more than one salt could be prepared from Fehling's solution, but on shaking the latter with alcohol, separating, and washing for hours with alcohol, the blue compound obtained was strongly alkaline.

Mr. Pickering said, in reply, that since the cupricarbonates could not be isolated, the formulæ given for them must be regarded only as suggestions. Very probably they were symmetrical, which, in the case of the α-compound, would involve the combination of $3Na_2CO_3$ with every $CuCO_3$, as suggested by Mr. Reynolds. The constitution of Fehling's solution had not been investigated, beyond ascertaining that its oxidising properties depended on the presence of electro-negative copper. The nature of the action between cellulose and the β-cupricarbonate was not clear, but the former appeared to be unaffected by it after the copper was removed.

*165. "*iso*Quinoline derivatives. Part I. Oxidation of laudanosine." By Frank Lee Pyman.

Just as narcotine and hydrastine yield on oxidation opianic acid together with cotarnine and hydrastinine respectively, so laudanosine (*N*-methyltetrahydropapaverine) yields veratraldehyde and a new base, 4 : 5-*dimethoxy*-2-*β*-*methylaminoethylbenzaldehyde*, $C_{12}H_{17}O_3N$. The chemical behaviour of this compound is very similar to that of cotarnine; it is colourless, but yields primrose-coloured salts, derived from 6 : 7-dimethoxy-2-methyl-3 : 4-dihydro*iso*quinolinium hydroxide by substitution. The addition of aqueous potassium cyanide to a solution of the chloride precipitates 1-*cyano*-6 : 7-*dimethoxy*-2-*methyltetrahydro*iso*quinoline*, $C_{13}H_{16}O_2N_2$, and boiling aqueous sodium hydroxide converts the aldehyde-base into the anhydrides of the corresponding acid and alcohol, 1-*keto*-6 : 7-*dimethoxy*-2-*methyltetrahydro*iso*quinoline*, $C_{12}H_{15}O_3N$, and 6 : 7-*dimethoxy*-2-*methyltetrahydro*iso*quinoline*, $C_{12}H_{17}O_2N$. The aldehyde-base yields an acetone condensation product, *bis*(4 : 5-*dimethoxy*-2-*β*-*methylaminoethylbenzylidene*)-*acetone*, $C_{27}H_{36}O_5N_2$.

*166. "The colour and constitution of azo-compounds." By John Theodore Hewitt and William Thomas.

Further information regarding the colour exhibited by doubly substituted azo-compounds has been collected, and the following substances have been examined.

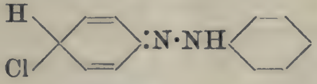
1. *p*-Acetylaminobenzeneazophenol.
2. *p*-Aminobenzeneazophenol and its dihydrochloride.
3. *p*-Dimethylaminobenzeneazophenol; its mono- and di-hydrochlorides and acetyl derivative.
4. *p*-Trimethylammonium iodide-benzeneazophenol.
5. *p*-Dimethylaminobenzeneazoanisole.
6. *p*-Trimethylammonium iodide-benzeneazoanisole.

Substances 2, 3, 4, 5, and 6 give yellow solutions in neutral solvents; 2, 3, and 5 give red or magenta solutions in dilute hydrochloric acid (formation of monohydrochloride), whilst in concentrated hydrochloric acid the solutions become orange in colour (dihydrochloride—oxonium salt).

Solutions of 4 and 6 remain yellow in dilute acid, but give orange solutions like the other substances in concentrated acid.

Discussion.

Mr. Baly pointed out that there seemed to him to be certain objections to Dr. Hewitt's explanation of the origin of the increased absorption of the hydrochlorides of the substituted azo-compounds. In the first place, it must be remembered that the addition of hydrochloric acid, if it be added to the molecule in the way suggested, must decrease the residual affinity of the molecule, and therefore it was difficult to understand how the absorption could thereby be increased, since the amount of absorption depended directly on the residual affinity of a compound. In the second place, the quinonoid structure advanced by Dr. Hewitt would not be expected to have so decidedly a deeper colour than the parent substance, since Mr. Tuck had shown that although there was a difference between the two isomeric compounds: $C_6H_5\cdot N\colon N\cdot C_6H_4\cdot OBz$ and $C_6H_5\cdot NBz\cdot N\colon C_6H_4\colon O$, yet this difference was in no way comparable with that between hydroxyazobenzene and its hydrochloride. In the third place, since azobenzene itself gave a hydrochloride far more deeply coloured than the parent substance, it would appear that any explanation of the colour of the hydrochlorides of the substituted azo-compounds must also be capable of explaining the similar phenomenon as observed with azobenzene itself. It was true that an analogous structure for azobenzene hydrochloride might be written:



but this appeared to be improbable.

About a year ago Miss Marsden and he showed that the amino-aldehydes and -ketones of the aromatic series displayed a great increase in absorption in the presence of a small quantity of hydrogen chloride in alcoholic solution, although the true hydrochlorides were colourless. Dr. Lapworth had suggested that this increase in colour might be due to the formation of an electro-positive ion, for example, $CHO\cdot C_6H_4\cdot\overset{+}{N}H_3$, where the nitrogen atom was quinquevalent, and so possessed an increased residual affinity. The hydrochloride (undissociated) would naturally be colourless, owing to the entire removal of the residual affinity of the amino-group. He (the speaker) suggested that possibly some analogous condition might obtain with the azo-grouping, and that a positive ion might be formed, thus: $C_6H_5\cdot\overset{+}{N}H\colon N\cdot C_6H_5$. The residual affinity of the azo-linking would then be increased, and the suggestion would have the merit of applying equally well to azobenzene and its substituted derivatives.

Dr. Hewitt, in reply, said that Dr. Lapworth's observation that the addition of alcoholic hydrochloric acid to alcoholic aminoazobenzene first produced an orange colour which afterwards turned purple, might be due to the transitory production of a salt of benzeneazophenylammonium, which was afterwards transformed into the quinonoid salt.

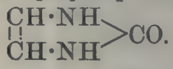
Mr. Baly's objection to the quinonoid formulæ for the salts was not supported by the chemical facts. Free benzeneazophenol behaved as a hydroxylic aromatic compound towards substituting agents, but in its salts with acids, the original phenolic nucleus resisted the action of nitric acid, but now was easily substituted in the other nucleus as if it were an anilide or hydrazone. Similar arguments could be brought forward with regard to the aminazo-compounds.

*167. "Studies of dynamic isomerism. Part IX. The relationship between absorption spectra and isomeric change. Absorption spectra of sulphonic derivatives of camphor." By Thomas Martin Lowry and Cecil Henry Desch.

The band which is present in the absorption spectrum of α-bromocamphor appears also in the spectra of the ammonium π-sulphonate, the π-sulphonamide, and the acetyl derivative of this amide. It is also observed in the potassium β-sulphonate, the β-sulphonamide, the β-sulphonanhydramide, and the sulphopiperidide (m. p. 75°) derived from α-bromocamphor, but disappears when the two α-hydrogen atoms are displaced by halogens, as in dibromocamphor β-sulphonanhydramide. In the case of α-chlorocamphor, the band is also absent from the spectrum of the mono-substituted anhydramide, although it is developed by the β-sulphonamide and the potassium β-sulphonate. In the case of camphor and α-methylcamphor, the sulphonic acids and their salts give rise to a band, but the amide and anhydramide give continuous absorption curves. The absorption bands of the alkali-sulphonates are weakened by the addition of an excess of alkali, although this is an essential condition for bringing about isomeric change.

168. "*iso*Iminazolone."

By Henry John Horstman Fenton and W. A. R. Wilks.

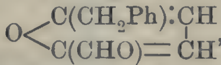
When dry dihydroxymaleic acid is intimately mixed with excess of carbamide and the mixture is heated to 100°, three distinct products are obtained; one of these is a compound which is sparingly soluble in water, crystallises in the tetragonal system, and gives an intense red colour with ferric chloride. Analysis and molecular-weight determination show that this compound has the formula $C_3H_4ON_2$, and its mode of formation suggests the constitution:  $\begin{matrix}\mathrm{CH{\cdot}NH}\\ \| \\ \mathrm{CH{\cdot}NH}\end{matrix}\!>\!\mathrm{CO}$. It appears, however, to differ notably in many respects from the "μ-iminazolone" obtained by Marckwald and Ellinger (*Ber.*, 1892, **25**, 2357).

When evaporated with chlorine water, or with hydrochloric acid and a trace of potassium chlorate, *iso*iminazolone leaves a brilliant pink residue, which is changed to violet by ammonia. Its behaviour in this respect is indeed closely analogous to that of uric acid or xanthine, and it is considered probable that erroneous conclusions may have been arrived at by former investigators in placing too much reliance on this colour reaction as indicative of purine derivatives.

169. "Homologues of furfuraldehyde."

By Henry John Horstman Fenton and F. Robinson.

The halogen derivatives of methylfurfuraldehyde are readily obtained by the action of dry halogen acids on ketohexoses, such as lævulose, or on various forms of cellulose (compare Fenton and Gostling, *Trans.*, 1899, **75**, 423; 1901, **79**, 807). The authors have studied the application of the Friedel and Crafts' reaction in effecting syntheses by these halogen derivatives, and further evidence is brought forward in support of the constitution previously assigned to these compounds.

Benzylfurfuraldehyde,  $\mathrm{O}\Big\langle\begin{matrix}\mathrm{C(CH_2Ph){:}CH}\\ \qquad\qquad\;\;|\\ \mathrm{C(CHO){=}CH}\end{matrix}$, obtained by the interaction of chloromethylfurfuraldehyde and benzene in presence of aluminium chloride, crystallises in large, colourless prisms, which melt at 31°. The *benzylphenylhydrazone* and the *oxime* are colourless and crystalline, and the latter has been obtained in two stereoisomeric forms.

Chloromethylfurfuraldehyde is easily oxidised by means of dilute nitric acid, yielding a dibasic acid, $C_4H_2O(CO_2H)_2$, which is identical with furan-2 : 5-dicarboxylic acid (dehydromucic acid).

170. "The relation between the strengths of acids and bases, and the quantitative distribution of affinity in the molecule. Part II." By Bernhard Flürscheim.

In Part I (*Trans.*, 1909, **95**, 718), it was mentioned that a few amines had affinity values which were not in agreement with the theory then published. In order to determine these anew, it was first necessary to improve Farmer and Warth's distribution method, since the results obtained by these authors sometimes differ considerably from those obtained by other methods, a fact which has been attributed by Lundén to possible association. Two new ways for determining volatile amines in the benzene layer have been worked out, one consisting in distilling off the benzene in a current of dry hydrogen chloride and heating the residue in a current of the same gas; the other, in retaining the amine by a weighed amount of picric acid. The latter method was shown to reduce the experimental error to less than one milligram. Determinations in very dilute solution were thus rendered possible, giving, for *m*-toluidine, for instance, results in agreement with those obtained by Bredig by the conductivity method. In this way, the halogen-substituted anilines, previously disagreeing with the theory, were found to be in perfect harmony with the same, and thus to constitute another experimental proof in its favour.

171. "The oxidation of hydroxy-derivatives of benzaldehyde and acetophenone." By Henry Drysdale Dakin.

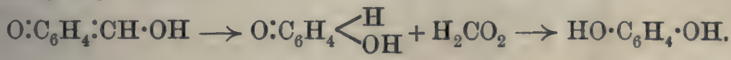
Ortho- and para-hydroxybenzaldehydes, when warmed with ammonia and hydrogen peroxide, readily give good yields of catechol and quinol respectively. Similarly, *o*- and *p*-hydroxyacetophenones yield the same products. The amount of hydroxybenzoic acid formed in both cases is quite insignificant. The corresponding *m*-hydroxy-derivatives, on similar treatment, undergo normal oxidation and yield *m*-hydroxybenzoic acid.

A number of other *o*- and *p*-hydroxy-derivatives were found to behave similarly on oxidation. 5-Nitro-2-hydroxybenzaldehyde gives nitrocatechol, and 4-hydroxy-3-methylbenzaldehyde and 2-hydroxy-4-methoxyacetophenone yield 2-methoxyquinol and 4-methoxyquinol respectively. Resacetophenone and 2:5-dihydroxyacetophenone probably react in the same manner, but the resulting trihydric phenols are too unstable in alkaline solution to be easily isolated.

If the hydroxyl group in the *o*- or *p*-hydroxybenzaldehyde and hydroxyacetophenone be replaced by a methoxy-, ethoxy-, nitro-, or amino-group, no formation of a phenol occurs, but usually a small yield of the corresponding benzoic acid is obtained.

A large number of methoxy-, ethoxy-, nitro-, and amino-derivatives of benzaldehyde and acetophenone, which did not contain a free hydroxy-group in the *o*- or *p*-position, were all found to yield the corresponding benzoic acids on oxidation. The yields were usually small, as these substances are much more resistant to the action of hydrogen peroxide than the *o*- and *p*-hydroxy-derivatives. The above results may be explained on the assumption that the salts of *o*- and *p*-hydroxybenzaldehydes and the *o*- and *p*-hydroxyacetophenones possess a quinonoid structure, as already suggested by Hantzsch in the case of some of the salts of *o*-hydroxybenzaldehyde (*Ber.*, 1906, **39**, 3081), and it also furnishes an explanation of the different behaviour on oxidation of the corresponding *m*-compounds, which presumably do not possess this structure.

The oxidation of *p*-hydroxybenzaldehyde may be represented in the following way:



$$\mathrm{O{:}C_6H_4{:}CH{\cdot}OH \longrightarrow O{:}C_6H_4{<}^{H}_{OH} + H_2CO_2 \longrightarrow HO{\cdot}C_6H_4{\cdot}OH.}$$

172. "The intramolecular rearrangement of diphenylamine orthosulphoxides." By Edward de Barry Barnett and Samuel Smiles.

It was shown that the orthosulphoxides of diphenylamine are converted by the action of certain acid reagents into the orthoquinonoid derivatives of phenazothionium. The reaction has been studied with the tetranitro-, di-*p*-nitro-, *iso*dinitro-, and the unsubstituted sulphoxide, and it has been found that the change proceeds the more readily the stronger the basic properties of the quadrivalent sulphur. The last-named sulphoxide furnishes phenazothionium chloride.

173. "Double and triple ferrocyanides of magnesium, aluminium, and cerium with potassium and ammonium." By Frederic William Robinson.

The author has investigated the above salts in order to ascertain whether the triple salts are definite compounds or isomorphous mixtures of double salts.

Magnesium.—Salts of the composition $\mathrm{R_2MgFeC_6N_6}$ (R being the alkali metal) have been obtained and their properties investigated. Salts of varying composition, $\mathrm{[RR_1]_2MgFeC_6N_6}$, were produced under different conditions, the ratio $\mathrm{R/R_1}$ varying according to the conditions of preparation.

Aluminium.—Salts of the composition $\mathrm{RAlFeC_6N_6,4H_2O}$ were isolated, which, when dehydrated, are very similar to Prussian-blue. A series of triple salts, $\mathrm{[NH_4,K]AlFeC_6N_6}$, was prepared, and when the alkali metal was in large excess, salts were obtained containing two equivalents of the alkali metal and two of aluminium per unit of acid radicle.

Cerium.—Crystalline double salts have been obtained possessing the composition $\mathrm{RCeFeC_6N_6}$. They exhibit very similar phenomena both in their formation and properties to the analogous aluminium salts. The constitution of the triple cerium potassium ammonium salts has also been established.

174. "Action of Grignard's reagent on ethyl oxalate."
By John Kenneth Harold Inglis and Alfred Sidell Mason.

In the hope of finding a convenient method of obtaining α-ketonic acids, the above action has been investigated. It was supposed that by acting on the ester with magnesium ethyl halide the hydrolysis of the resulting additive product would yield propionylformic acid according to the following scheme:

$$(CO_2Et)_2 \longrightarrow CO_2Et\cdot CEt(OEt)\cdot OMgBr \longrightarrow CO_2Et\cdot CEt(OH)_2 \longrightarrow C_2H_5\cdot CO\cdot CO_2Et.$$

Magnesium ethyl bromide was therefore allowed to react with the dry ester in molecular proportions. After hydrolysis of the resulting mixture with dilute sulphuric acid and ice, the ethereal solution was dried and fractionally distilled under 25 mm. pressure. The acid boils at 74—78°/25 mm., and the ester at 74—77°/25 mm. Between 74° and 83° 12·5 grams of a pale yellow liquid were obtained, the theoretical yield for the ester being 65 grams. This liquid appeared to be a mixture of ester and acid. The oxime of the acid melted sharply at 154°, the melting point of α-oximinobutyric acid.

Similar experiments were carried out with magnesium phenyl bromide in the expectation of obtaining phenylglyoxylic ester. This ester boils at 151—154°/30—40 mm., and 18 grams of a yellow oil were obtained boiling between 140° and 160°, the theoretical amount being 89 grams. The phenylhydrazone of the acid was prepared and found to contain 11·86 per cent. of nitrogen (theoretical, 11·66); after recrystallisation from alcohol it melted at 147°. The attempt to isolate the acid was, however, unsuccessful.

The above results point to the possibility of preparing these two esters from oxalic ester. It is hoped to continue these experiments with a view to ascertain the conditions under which the yield may be increased.

175. "The partial racemism of menthyl *r*-mandelate."
By Alexander Findlay and Evelyn Marion Hickmans.

From a study of the solubility relations at 35°, 25°, 10°, and 0°, it has been found that *l*-menthyl *r*-mandelate is stable at these temperatures, and from a crystallisation experiment at −15°, it would appear that even at this temperature the transition point has not been reached, so that resolution of *r*-mandelic acid by crystallisation of its *l*-menthyl ester cannot be effected at temperatures above −15°. The transition point must lie below this, and has not been determined.

176. "The primary interaction of chlorine with acylanilides."
By Kennedy Joseph Previté Orton and William Jacob Jones.

It has been shown, by measuring the free chlorine in the solution, that chlorine and acylanilides (or chloroamines and hydrochloric acid) in acetic acid solution enter into a reversible reaction, which is represented by the equation: $Ar{\cdot}NHAc + Cl_2 \rightleftarrows Ar{\cdot}NClAc + HCl$. Equilibrium is attained extremely rapidly, but is gradually disturbed by the chlorination of the anilide (when that is possible) which follows slowly on the primary reaction.

The following table gives the extent of the reaction in various cases when the anilide and the chlorine are respectively in the first instance at a concentration of 0·025 gram-molecule per litre:

Anilide.	Percentage of chlorine combined in 75 per cent. acetic acid.	Percentage of chlorine combined in 90 per cent. acetic acid.	Percentage of chlorine combined in glacial acetic acid.
$(p)NO_2{\cdot}C_6H_4{\cdot}NHAc$	39·5	11	0
$(2:4)Cl_2{:}C_6H_3{\cdot}NHAc$	80	34	0
$(2:4)Cl_2{:}C_6H_3{\cdot}NH{\cdot}CHO$ ...	83·5	32	0
$(2:4)Cl_2{:}C_6H_3{\cdot}NHBz$	62	14	0
$(s)Br_3{:}C_6H_2{\cdot}NHAc$	86	43	0

The measurements in 90 per cent. acetic acid lead to an equilibrium constant, but in 75 per cent. no constant can be calculated. In 65 per cent. acetic acid, a constant is obtained if the reaction is represented as: $Ar{\cdot}NHAc + Cl_2 \rightleftarrows Ar{\cdot}NClAc + H^{\cdot} + Cl'$, that is, the equilibrium constant is proportional to the square of the concentration of the hydrochloric acid.

It will be seen that the primary reaction between the anilide and the chlorine does not occur to a measurable extent in glacial acetic acid; nevertheless, in the presence of a molecular proportion of sodium acetate, more than 90 per cent. of the chlorine reacts. In 50 per cent. acetic acid, on the other hand, there was only a trace of free chlorine.

The method of estimating the free chlorine, which requires only two to three minutes, consists in the aspiration of a small volume of air through the solution, such that about 5 per cent. of the free chlorine is extracted. Comparison with experiments made with standard solutions of chlorine gives the measure of free chlorine. With the apparatus which the authors have elaborated, the measurements can be made with a high degree of accuracy, the differences in the value of the free chlorine in two similar experiments never exceeding 0·05 c.c. of $N/10$ thiosulphate.

177. "The quantitative decomposition of the anilides: a study in steric influence." By Oliver Charles Minty Davis.

A series of experiments have been carried out on the quantitative hydrolysis of the anilides by means of sodium hydroxide.

The object of the research was to investigate the effect of orientation in the selected compounds on their chemical reactivity.

A considerable number of anilides were experimented on, and the main result of the work is to show that under the conditions chosen by the author the chief effect of substituent elements and groups (and their position in the molecule) is to influence the rate of decomposition.

178. "Note on the anomalous viscosity of nitrobenzene."

By Ferdinand Bernard Thole.

In support of his theory of "motoisomerism" (*Ber.*, 1907, **40**, 508), Knoevenagel quoted the results obtained by Mühlenbein with regard to the viscosity of nitrobenzene.

Mühlenbein (*Diss.*, Cöthen, 1901) stated that the viscosity of freshly distilled nitrobenzene decreased by 0·7 per cent. on standing for some hours. This he attributed to a change in the configuration of the nitro-group. He also drew attention to the fact that specimens of quinoline derived from various sources possess widely different densities and viscosities. The boiling points of the specimens used, however, seemed to show that these were by no means sufficiently pure to give trustworthy physical constants.

Repetition of Mühlenbein's work on nitrobenzene does not confirm his results.

The mean results of four series of observations using nitrobenzene from various sources are as follows:

	Immediately after distillation.	After 22 hours.
Mean density (25°/4°) …………	1·19870	1·19869
Mean viscosity (25° C.)…………	0·018226	0·018224

The mean difference in viscosity, namely, 0·012 per cent., is well within the limits of experimental error.

The carefully purified quinoline used (b. p. 235°) had a density of 1·08994 and a viscosity of 0·033724. Mühlenbein obtained densities varying between 1·08228 and 1·09351, and viscosities between 0·033911 and 0·045405.

The Viscosity of Ethyl Acetoacetate.—Schaum (*Ber.*, 1898, **31**, 1964) and Dunstan and Stubbs (Trans., 1908, **92**, 1919) have pointed out that the physical constants of freshly distilled ethyl acetoacetate change on keeping the ester for some time. A closer study of this change has been carried out, and curves have been plotted showing the change of viscosity and density with time.

The viscosity and density are found to increase rapidly at first, and then more slowly, until equilibrium is attained. Extrapolation gives a density of, approximately, 1·02045 and a viscosity of 0·015210 for the ester immediately after distillation.

The low initial viscosity shows that the freshly distilled liquid exists almost entirely in the ketonic form.

179. "Studies of the carbonates. Part I. The equilibrium between calcium carbonate and carbonic acid." By Clarence Arthur Seyler and Percy Vivian Lloyd.

Schlössing's law has been verified by means of double titration with methyl-orange and phenolphthalein as indicators.

The following general law has been established in the case of waters containing calcium chloride and sulphate, sodium bicarbonate, chloride, and sulphate, and magnesium sulphate in quantities such as occur in fresh natural waters. "When a water is in equilibrium with the limestone which it percolates, the square of the alkalinity is directly proportional to the free carbonic acid and inversely to the total hardness." The alkalinity and hardness being expressed in gram-equivalents per litre and corrected for degree of ionisation, the constant has the value $F + 10^{-6}$, where F is on the average 113.

The constant F is called the "saturation factor" of the water, and is a criterion as to whether the water is saturated or not with the limestone.

For mineral water or sea-water the factor would be higher.

For different forms of calcium carbonate (calcite and arragonite) the factor F is proportional to the "solubility product" and to the square of the solubility in pure water.

180. "Some esters of arsenious acid. Part II. Resorcinyl arsenite." By William Robert Lang and John Obins Woodhouse.

Continuing the experiments described in a previous communication (Lang, MacKey, and Gortner, *Trans.*, 1908, **93**, 1364), but using one of the dihydric phenols, quantities by weight of resorcinol and of arsenious oxide corresponding with the equation below were heated to the melting point of the former in a distilling flask, connected through a weighed flask with an exhaust pump. The temperature was kept constant, and the arsenic slowly dissolved in the melted resorcinol, yielding an amber-coloured fluid becoming darker as the heating progressed, the pressure being 60 mm. The water evolved in the reaction, $3C_6H_4(OH)_2 + As_2O_3 = (C_6H_4O_2)_3As_2 + 3H_2O$, collected in the trap and was weighed as a check, due precautions being taken to prevent loss. After heating for fifty-five minutes the mixture was allowed to cool, broken up, and extracted with hot toluene, which removed from it some resorcinol. The residue was dissolved in dry ethyl alcohol, in which these esters are soluble, when an immediate precipitate of arsenious oxide was produced. Analysis of the substance obtained on evaporation in a vacuum of the alcoholic extract proved it to contain from 5 to 6 per cent. of arsenious oxide in excess of that required by the formula $(C_6H_4O_2)_3As_2$, showing that arsenious oxide dissolved in the ester formed. To prevent this, an excess of resorcinol was employed, namely, 100 grams, and 50 grams of arsenious oxide heated with it as before, the proportions of the former to the latter being, according to the equation supposed to represent the reaction, 100 to 60; in this way an amount of resorcinol corresponding with 10 grams of arsenious oxide would, of necessity, remain unacted on and be readily extracted from the ester by a specific solvent. After an hour's heating, the solidified mass was broken up and digested in a reflux condenser with dry toluene, which extracted a considerable proportion of resorcinol. This treatment was repeated until no more resorcinol could be obtained on evaporation of the solvent. The resorcinol-free mass was analysed as follows. About 1 gram was treated with water, which caused its immediate decomposition, the solution acidified with hydrochloric acid, and the arsenic precipitated as sulphide, dried on a tared filter, and weighed. The results of numerous analyses, which closely corresponded, gave:

Found, As = 31·9. $C_{18}H_{12}O_6As_2$ requires As = 31·65 per cent.

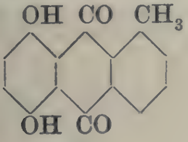
Resorcinyl arsenite closely resembles hardened gelatin in appearance, melts at 24°, and has a specific gravity of 1·9. It is soluble in methyl, ethyl, propyl, and butyl alcohols, but insoluble in ether, chloroform, benzene, or toluene. Water, however, immediately decomposes it.

The same experiments were tried with quinol, but, so far, without success.

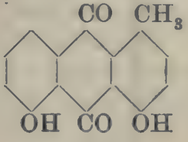
181. "The constitution of chrysophanic acid and of emodin." (Preliminary note.) By Frank Tutin and Hubert William Bentley Clewer.

It was considered highly probable by Jowett and Potter (*Trans.*, 1903, **83**, 1327) that chrysophanic acid is represented by formula (I), and that emodin differed from this compound by the presence of one additional hydroxyl group.

By a comparison of the properties of quinizarin and 2-methylquinizarin respectively with those of chrysophanic acid, the present authors have obtained conclusive proof that the last-mentioned compound does not contain the quinol grouping. There is reason to believe, furthermore, that chrysophanic acid is represented by formula (II), that is to say, that it is 1-*methylchrysazin.* Emodin



(I.)



(II.)

will then be, in all probability, a *hydroxy*-1-*methylchrysazin*, but the position of the additional hydroxyl group is at present uncertain.

The work is being continued, and it is hoped to obtain further evidence in support of the above conclusions, which, if they are correct, indicate that chrysophanic acid is very closely related to both aloe-emodin and rhein (compare Robinson and Simonsen, *Proc.*, 1909, **26**, 76).

182. "The morphotropic relationships between the derivatives of picric acid." By George Jerusalem.

The author has prepared a number of salts of picric and styphnic acids with primary, secondary, and tertiary amines and quaternary ammonium bases, and has determined their crystallographic constants. The discussion of the data thus obtained shows that the crystalline forms of these substances all fall into the scheme devised by Barlow and Pope; a considerable amount of quantitative confirmation of the correctness of the structure assigned to benzene by these authors has thus been collected.

The author further shows that the molecular volumes of the salts in question are directly proportional, within limits of + or − 4 per cent., to the sums of the valencies composing the molecular complexes. Further confirmation is thus provided of the conclusion that each atom in a compound substance appropriates a portion of the total volume directly proportional to its fundamental valency.

183. "A possible intramolecular change in the inactive phenylalkyloxyacetic acids." (Preliminary note.) By William Ernest Stephen Turner.

Attention has already been drawn to the steady decrease occurring, as dilution proceeds, in the values of the dissociation constants of phenyl-methoxy-, -ethoxy-, and -propoxy-acetic acids (Findlay, Turner, and Owen, *Trans.*, 1909, **95**, 939).

The author has found that aqueous solutions of phenylpropoxyacetic acid become yellow on keeping for a long period, and deposit a yellow solid from which, by means of ether, pale yellow, needle-shaped crystals, m. p. 144°, have been obtained. Moreover, in the liquid state, carefully purified samples of the ethoxy- and propoxy-acids deposit yellow needles at a very slow rate.

The crystals isolated from the liquid propoxy-acid consist of two substances, the main constituent melting at 152°. Physico-chemical experiments show that whereas these crystals have the same molecular weight as phenylpropoxyacetic acid, they differ from it in constitution.

Owing to the slow rate at which it proceeds, and the consequent difficulty of accumulating materials, the exact nature of the change occurring cannot yet be determined.

184. "The colour and constitution of diazonium salts. Part I."

By Gilbert T. Morgan and Mary Alcock.

The diazonium salts of benzoyl-1 : 4-naphthylenediamine, which are stable coloured substances, have now been compared with the corresponding derivatives of benzoyl-*p*-phenylenediamine and its alkylated homologues.

*Benzoyl-*p*-aminobenzenediazonium chloride* and the corresponding *nitrate*, *sulphate*, *perchlorate*, and *acetate* are also remarkably stable, but colourless when freshly prepared. as-*Benzoylmethyl-*p*-phenylenediamine* and as-*benzoylethyl-*p*-phenylenediamine*, colourless needles, m. p. 153—154° and 117° respectively, give rise to colourless, oily diazonium salts with the commoner mineral acids; their *diazonium molybdates* and *tungstates* are, however, solid and colourless.

The conclusion is drawn that the absence of colour in the diazonium salts of benzoyl-*p*-phenylenediamine and its homologues, and the presence of colour in the corresponding series of diazo-derivatives from benzoyl-1 : 4-naphthylenediamine, is dependent on the differences between the chromogenic properties of the benzene and naphthalene nuclei respectively, rather than to any variation in the structure of the diazonium complex contained in the coloured salts derived from the naphthalene base.

The foregoing diazonium salts couple with the undiazotised base in the usual way to form diazoamines, such as the compound

$$C_6H_5\cdot CO\cdot NH\cdot C_6H_4\cdot N_2\cdot NH\cdot C_6H_4\cdot NH\cdot CO\cdot C_6H_5,$$

but when treated with aqueous sodium hydroxide or ammonia they lose a portion of the diazo-nitrogen and yield diazo-oxides, as, for example, $C_6H_5\cdot CO\cdot NH\cdot C_6H_4\cdot N_2\cdot O\cdot C_6H_4\cdot NH\cdot CO\cdot C_6H_5$.

185. "The hydrolysis of amygdalin by acids. Part I."

By James Wallace Walker and Vernon K. Krieble.

A comparative examination has been made of the action of dilute and concentrated hydrochloric and sulphuric acids as well as of concentrated aqueous oxalic and trichloroacetic acids on amygdalin. It is found that, whilst concentrated hydrochloric acid first attacks the nitrile radicle, producing *l*-amygdalinic acid, a solution of sulphuric acid of corresponding strength liberates *l*-mandelonitrile. Oxalic acid behaves in a manner similar to dilute hydrochloric, but trichloroacetic acid does not hydrolyse amygdalin at all under the same conditions of temperature and concentration at which hydrochloric acid readily effects the hydrolysis.

186. "Some derivatives of anthraquinone."

By Dorothy Harrop, Roland Victor Norris, and Charles Weizmann.

The authors have prepared a number of derivatives of 1 : 2-, 1 : 3-, and 1 : 4-dimethylanthraquinone. By the action of sulphuric and boric acids on the dichlorodimethylbenzoylbenzoic acids produced by condensing 1 : 4 dichlorophthalic anhydride with the three xylenes in presence of aluminium chloride, the corresponding dichlorodimethylanthraquinones are obtained. The chlorine atoms in the latter compounds are easily displaced, and the corresponding dianilino-, diphenoxy-, and dithiophenoxy-derivatives have been isolated.

The following note has been received since the meeting :—

187. "Isomeric derivatives of phosphoric acid."

By Frederic Stanley Kipping and Bernard Dunstan Wilkinson Luff.

Many salts prepared by combining phenyl-*p*-tolylphosphoric acid, $PO(OPh)(O\cdot C_6H_4Me)\cdot OH$, with an optically active base have been examined, but so far all attempts to resolve the acid have been unsuccessful. Nevertheless, evidence that the acid is a mixture of isomerides has been obtained by treating phenyl-*p*-tolylphosphoric chloride with asymmetric bases (compare Kipping and Hall, *Trans.*, 1901, **79**, 442). With *dl*-hydrindamine, for example, the chloride yields a mixture of two isomeric hydrindamides, $PO(OPh)(O\cdot C_6H_4Me)\cdot NH\cdot C_9H_9$, one of which melts at 97—99°, the other at about 81—83°; similarly with *d*-hydrindamine, or with *l*-menthylamine, the chloride gives two isomeric amides. The more sparingly soluble compound is readily isolated in all three cases, but the more readily soluble one, which seems to form half of the original product, is not easily obtained free from its isomeride.

These results seem to prove that phenyl-*p*-tolylphosphoric acid is an externally compensated compound, and further experiments on the resolution of this and of similar derivatives of phosphoric acid are in progress.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Blair, *David.* A grammar of the principles and practice of chemistry. pp. vi + 255. ill. London 1815. (*Recd.* 3/6/09.)
From Mr. A. H. Coote.

Lister Institute of Preventive Medicine. Collected papers, No. 5. London 1908. (*Reference.*) From the Director.

II. *By Purchase.*

Delbrück, *Max.* [*Editor.*] Brauerei-Lexikon. Lief 1. pp. 80. ill. Berlin 1909. (*Reference.*)

Diergart, *Paul.* [*Editor.*] Beiträge aus der Geschichte der Chemie dem Gedächtnis von Georg W. A. Kahlbaum. pp. xv + 652. ill. Leipzig 1909. (*Recd.* 17/6/09.)

Hinrichsen, *F. W.* Die Untersuchung von Eisengallustinten. (Die chemische Analyse, Vol. VI.) pp. 140. Stuttgart 1909. (*Recd.* 9/6/09.)

Kahlbaum, *Georg W. A.* See **Diergart**, *Paul.*

Kremann, *R.* Ueber die Anwendung der thermischen Analyse zum Nachweis chemischer Verbindungen. (Sammlung, Vol. XIV.) Stuttgart 1909. (*Recd.* 10/6/09.)

Law, *Edward F.* Alloys and their industrial applications. pp. xvi + 269. ill. London 1909. (*Recd.* 22/6/09.)

Marchlewski, *L.* Die Chemie der Chlorophylle und ihre Beziehung zur Chemie des Blutfarbstoffs. pp. x + 187. ill. Braunschweig 1909. (*Recd.* 17/6/09.)

Naske, *Carl.* Die Portland-Zement-Fabrikation. 2nd edition. pp. vii + 410. ill. Leipzig 1909. (*Recd.* 17/6/09.)

Richter, *Victor von.* Chemie der Kohlenstoffverbindungen oder organische Chemie. Edited by *R.* **Anschütz** and *G.* **Schroeter**. Vol. I. Die Chemie der Fettkörper. 11th edition. pp. xx + 793. Bonn 1909. (*Reference.*)

Schucht, *Ludwig.* Die Fabrikation des Superphosphats, mit Berücksichtigung der anderen gebräuchlichen Düngemittel. 3rd edition. pp. viii + 460. ill. Braunschweig 1909. (*Recd.* 17/6/09.)

THE LIBRARY.

The Library will be closed for Stocktaking from **Monday, August 9th**, until **Saturday, August 21st**, 1909, inclusive.

Fellows are particularly requested to return all Library Books in their possession **not later than Wednesday, August 4th.**

LIST OF FELLOWS, 1909.

The List of Fellows for 1909 is now in active preparation, and changes of address received after 31st July cannot be included in it.

In order that the new list may be as complete as possible, those Fellows whose degrees and Christian names do not appear in full are requested to communicate them to the Assistant Secretary.

The next Ordinary Meeting will be held on **Thursday**, October 21st, 1909, at **8.30** p.m., when the Mendeléeff Memorial Lecture will be delivered by Professor W. A. Tilden, F.R.S., Past President.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 30/10/09.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 25. No. 360.

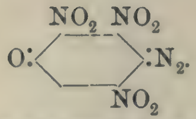
The following are abstracts of papers received during the vacation and published or passed for publication in the *Transactions*:

188. "The action of bromo*cyclo*hexane and of 4-bromo-1-methyl*cyclo*hexane on the sodium derivative of ethyl malonate." By Edward Hope and W. H. Perkin, jun. (Trans., 1909, 1360.)

The authors have prepared *ethyl* cyclo*hexylmalonate* and *ethyl* 1-*methyl*cyclo*hexyl*-4-*malonate* by the above reactions; the properties of these substances and their derivatives are described.

189. "2 : 3 : 5-Trinitro-4-aminophenol and derivatives." By Raphael Meldola and James Gordon Hay. (Trans., 1909, 1378.)

This compound has been isolated by the careful hydrolysis of the acetyl derivative by means of sulphuric acid. It crystallises from acetic acid in deep red needles decomposing at about 145°. The most important conclusion deduced from the study of the substance is that the loss of a nitro-group on diazotisation is primarily due to the mobility conferred by the presence of a methoxy-group, since the present compound, although highly nitrated and possessing a nitro-group in a most favourable position for elimination, can be diazotised with the retention of all its nitro-groups, the diazonium sulphate passing at once on dilution with water into 2:3:5-trinitroquinonediazide:



The 3-nitro-group of this compound is capable of being replaced by hydroxy- and alkyloxy-groups without the removal of the diazo-group.

190. "Colour and constitution of azo-compounds. Part IV." By John Theodore Hewitt and Ferdinand Bernard Thole. (Trans., 1909, 1393.)

In order to obtain more insight into the relationship between constitution and selective absorption, the following bisazo-compounds of relatively simple type have been prepared and examined.

Benzeneazobenzeneazodimethylaniline, m. p. 190° (uncorr.), and its hydrochloride, $C_{20}H_{19}N_5,HCl$; *o*-tolueneazo-*o*-tolueneazodimethylaniline, m. p. 138° (uncorr.), and its hydrochloride, $C_{22}H_{23}N_5,HCl$; benzeneazobenzeneazophenol, m. p. 180° (uncorr.); benzeneazobenzeneazophenyl acetate, m. p. 178° (uncorr.).

The absorption of these substances in acid solutions has been examined for the visible part of the spectrum. The dimethylamino-compounds dissolve in concentrated sulphuric acid with a red colour, passing to blue on dilution; the blue solutions correspond with the salts of a mono-acid base. The phenolic compound dissolves in concentrated sulphuric acid with a fine purple colour, dilution producing complete hydrolysis.

191. "The amygdalins. Part I."

By J. Wallace Walker and Vernon K. Krieble. (Trans., 1909, 1437.)

The study of the action of traces of alkali on *l*-amygdalin, first observed by one of the authors (Walker, *Trans.*, 1903, **83**, 472), has been continued, and a partial resolution of the racemised solution has been effected. The equilibrium between the different varieties has been found to be unaffected by changes in the concentration and nature of the alkali, or in the concentration of the amygdalin, or by temperature. The great difference in the action of emulsin on the several modifications shows, however, that a further change takes place in the racemised solution on heating, and renders it doubtful whether the crystalline material separated from the racemised solution contains *d*-amygdalin or an isomeric substance.

192. "The action of the Grignard reagent on phthalic esters." By Yūji Shibata. (Trans., 1909, 1449.)

The author has studied the action of the Grignard reagent on phthalic esters, and finds that, in spite of the close analogy of phthalic acid to succinic acid, the action of the Grignard reagent on phthalic esters differs from that on succinic esters in producing derivatives of phthalide, instead of glycols. More frequently, the reaction proceeds one step further, with the production of derivatives of phthalane. 1 : 1-*Dimethyl-3-methylenephthalane*, 1 : 1-*diphenyl-3-phenylenephthalane*, and 1 : 1-*dibenzyl-3-benzylidenephthalane* have thus been obtained. Of the various space formulæ proposed for benzene from time to time, that of Graebe, which represents Kekulé's well known formula in space, accounts most satisfactorily for the results obtained in this investigation.

193. "Constitution of hydroxyazo-compounds. Part II. Action of mercuric acetate on benzeneazonaphthols." By Alec Duncan Mitchell and Clarence Smith. (Trans., 1909, 1430.)

In continuation of former work (*Trans.*, 1908, **93**, 842), the action of mercuric acetate on hydroxyazo-compounds of the naphthalene series in alcohol has been examined. Benzeneazo-β-naphthol does not react with the salt, whilst benzeneazo-α-naphthol undergoes oxidation to Witt and Dedichen's ββ-dinaphthyl derivative (*Ber.*, 1897, **30**, 2660). When the β-position contains a substituent, the oxidation is prevented and monomercuriacetates are formed.

β-Benzeneazo-α-naphthol mercuriacetate,

$$C_6H_5\cdot N_2\cdot C_{10}H_5(OH)\cdot Hg\cdot CO_2\cdot CH_3,$$

m. p. 208° (decomp.), is a red powder sparingly soluble in the usual solvents, except glacial acetic acid; by prolonged boiling with the latter, the mercuriacetate group is replaced by hydrogen. *4-Nitro-2-benzeneazo-α-naphthol mercuriacetate*, $C_6H_5\cdot N_2\cdot C_{10}H_4(OH)(NO_2)\cdot Hg\cdot CO_2\cdot CH_3$, m. p. 221—222°, is a dull red powder obtained from *4-nitro-2-benzeneazo-α-naphthol*, m. p. 178—179°, which crystallises in dark red needles and forms an *acetate*, m. p. 208°, crystallising in orange-yellow needles. *2-Nitro-4-benzeneazo-α-naphthol mercuriacetate* is a lustrous, reddish-brown substance, which blackens on heating, but does not melt below 290°; it is obtained from *2-nitro-4-benzeneazo-α-naphthol*, m. p. 164°, which crystallises in orange-red needles, and forms an *acetate*, m. p. 173°, crystallising in red prisms. *Bisbenzeneazo-α-naphthol mercuriacetate*, $(C_6H_5\cdot N_2)_2C_{10}H_4(OH)\cdot Hg\cdot CO_2\cdot CH_3$, m. p. 235—239° (decomp.), separates from phenol generally as a dark purplish-brown mass, but on one occasion was obtained in black bronzy needles. *2′ : 4′ : 6′-Tribromo-2-nitro-4-benzeneazo-α-naphthol*, m. p. 216°, orange-yellow plates, *2′ : 4′ : 6′-tribromo-4-nitro-2-benzeneazo-α-naphthol*, m. p. 215—216°, orange-red needles, and *bis-2′ : 4′ : 6′-tribromobenzeneazo-α-naphthol*, m. p. 249—253°, a maroon powder, have also been prepared.

194. "Preparation of the acyl derivatives of the aldehydecyanohydrins. Part I." By Francis Francis and Oliver Charles Minty Davis. (Trans., 1909, 1403.)

It has been found that aromatic aldehydes readily react with acid chlorides in the presence of aqueous potassium cyanide to form the acyl derivatives of the corresponding cyanohydrins. The reaction may be generalised and expressed as follows :

$$R\cdot CHO + R'\cdot COCl + KCN \longrightarrow R\cdot CH(O\cdot COR')\cdot CN + KCl.$$

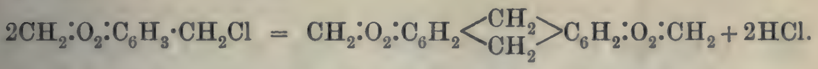
195. "The action of phosphorus pentachloride on the methylene ethers of catechol derivatives. Part V. Derivatives of protocatechuyl alcohol and protocatechuonitrile." By Arthur James Ewins. (Trans., 1909, 1482.)

No dichloromethylene derivative can be isolated by the direct action of phosphorus pentachloride on piperonyl alcohol (Barger, *Trans.*, 1908, **93**, 567); the corresponding chloride, $CH_2{:}O_2{:}C_6H_3\cdot CH_2Cl$ (Decker and Koch, *Ber.*, 1905, **38**, 1739), however, readily yields 3 : 4-dichloromethylenedioxybenzyl chloride, $CCl_2{:}O_2{:}C_6H_3\cdot CH_2Cl$, b. p. 154—156°/16 mm., which is transformed by formic acid into 3 : 4-carbonyldioxybenzyl chloride, $CO{:}O_2{:}C_6H_3\cdot CH_2Cl$, m. p. 57° (compare Pauly and Alexander, *Ber.*, 1909, **42**, 2350). By boiling 3 : 4-carbonyldioxybenzyl chloride with water, an impure crystalline catechol derivative free from chlorine was obtained (protocatechuyl alcohol ?).

By a similar series of reactions, piperonylonitrile yields successively 3 : 4-dichloromethylenedioxybenzonitrile, $CCl_2{:}O_2{:}C_6H_3\cdot CN$, b. p. 155—156°/15 mm., m. p. 76—77°, 3 : 4-carbonyldioxybenzonitrile, $CO{:}O_2{:}C_6H_3\cdot CN$, prisms from benzene, m. p. 112°, and 3 : 4-dihydroxybenzonitrile (protocatechuonitrile), $C_6H_3(OH)_2\cdot CN$, needles from water, m. p. 152°.

By the action of phosphorus pentachloride on 3 : 4-methylenedioxymandelamide, $CH_2{:}O_2{:}C_6H_3\cdot CH(OH)\cdot CO\cdot NH_2$ (Barger and Ewins, *Trans.*, 1909, **95**, 555), and boiling the product with formic acid, 3 : 4-methylenedioxyphenylglyoxylonitrile, $CH_2{:}O_2{:}C_6H_3\cdot CO\cdot CN$, was obtained.

The abnormal reaction between piperonyl alcohol and phosphorus pentachloride is due to the condensation, under the influence of phosphorus halides, of the piperonyl chloride first produced to a substance, $C_{16}H_{12}O_4$, m. p. above 360°, which sublimes under diminished pressure, and is probably related to anthracene. Its formation may be expressed by the equation:



$$2CH_2{:}O_2{:}C_6H_3{\cdot}CH_2Cl = CH_2{:}O_2{:}C_6H_2{<}{\substack{CH_2\\CH_2}}{>}C_6H_2{:}O_2{:}CH_2 + 2HCl.$$

A crystalline *nitro*-derivative of the probable composition

$$C_{16}H_{10}O_4(NO_2)_2$$

was obtained.

196. "The preparation of disulphides. Part VI. Note on a new method of preparing disulphides." By Thomas Slater Price and Douglas Frank Twiss. (Trans., 1909, 1489.)

Although alkyl thiosulphates do not react with iodine at the ordinary temperature, reaction readily takes place at higher temperatures, the corresponding disulphides being formed according to the equation: $2KO{\cdot}SO_2{\cdot}SR + 2H_2O + I_2 = R_2S_2 + 2KHSO_4 + 2HI$. The yield of disulphide is practically quantitative. The preparation of benzyl disulphide, *o*-nitrobenzyl disulphide, and dimethyl dithiodiglycollate is described.

197. "Halogen derivatives of cinnamic acid." By Thomas Campbell James and John Joseph Sudborough. (Trans., 1909, 1538.)

Further experiments have been made on the addition of bromine to methyl and ethyl cinnamate.

The action of alkalis on *d*- and *l*-cinnamic acid dibromides and on methyl and ethyl *allo*cinnamate dibromides has been studied, and also the action of various organic bases on cinnamic acid dibromide.

Attempts have been made to resolve α-bromo- and α-bromo-*allo*-cinnamic acids into optically active components, but without success.

198. "The conversion of pinene into sobrerol." By George Gerald Henderson and Wilfred James Stevenson Eastburn. (Trans., 1909, 1465.)

Not only the mixture of *d*- and *l*-pinene obtained from American oil of turpentine, but also *d*-pinene and *l*-pinene themselves yield the inactive modification of sobrerol when oxidised with aqueous mercuric acetate by the method formerly described, and therefore optical inversion occurs in the process.

Using the formation of sobrerol as a test, the presence of *d*-pinene in a specimen of Russian oil of turpentine has been proved, whilst a sample of Swedish oil of turpentine gave a negative result.

199. "Influence of various sodium salts on the solubility of sparingly soluble acids. Part II." By James Charles Philip and Frederick Basil Garner. (Trans., 1909, 1466.)

The work described in an earlier paper (*Trans.*, 1905, **87**, 987) has been extended. In harmony with what was then found, the authors find that the weaker the acid from which the sodium salt is derived, the greater is the influence of the salt on the solubility of benzoic, salicylic, *o*-chlorobenzoic, and *m*-nitrobenzoic acids. It is further found that if of two sparingly soluble acids the weaker is also the more soluble, then under the influence of any sodium salt the solubility of the stronger acid is increased to a greater extent than that of the other. The experimental figures for the solubility are compared with those calculated by Noyes' formula, and the agreement between the two sets of values is generally good.

200. "Organic derivatives of arsenic. Part II. Triaminotriphenylarsine oxide and tricamphorylarsinic acid." By Gilbert T. Morgan and Frances M. G. Micklethwait. (Trans., 1909, 1473.)

Triaminotriphenylarsine oxide, $O\colon As(C_6H_4\cdot NH_2)_3$, was produced by condensing aniline and arsenious chloride in boiling benzene or toluene, and treating the mixture with aqueous alkali.

Tricamphorylarsinic acid, $(C_{10}H_{15}O)_3As(OH)_2$, was isolated from the products of the interaction of sodium camphor and arsenious chloride.

201. "The estimation of arsenic in organic compounds." By Harry F. V. Little, Edward Cahen, and Gilbert T. Morgan (Trans., 1909, 1477.)

The compounds were heated with sodium peroxide and sodium carbonate, the acidified aqueous extract of the fusion boiled with potassium iodide, and the arsenic precipitated as sulphide. The precipitate was re-dissolved in aqueous sodium hydroxide, and the solution treated with hydrogen peroxide. After acidifying and boiling to decompose the excess of peroxide, the reduction with potassium iodide was repeated, the liberated iodine boiled off, and the resulting arsenious solution neutralised and titrated with standard iodine solution.

202. "A method of harmonising the atomic weights." By James Moir.

The author assumes the cause of valency to be the presence, in varying numbers, of a sub-element of atomic weight 1/112, and regards the main bulk of the mass of the elements as due to polymerisation of an entity consisting of the hydrogen atom, less the above aggregation; thus if the fraction 1/112 be represented by μ, a bivalent element contains 2μ, and denoting the entity referred to by $\overline{H}$, the atomic weight of oxygen, for example, $=16\overline{H}+2$. By the application of this idea, close agreement is found between the calculated and observed values for the atomic weights of the elements.

203. "The spontaneous crystallisation of solutions of sodium carbonate and sodium thiosulphate." By Bernard Mouat Jones.

(Trans., 1909, 1672.)

The author has determined the conditions under which spontaneous crystallisation takes place in the systems sodium carbonate-water and sodium thiosulphate-water when solutions of these salts, freed from crystal nuclei, are slowly cooled (or warmed) with constant shaking in the presence of glass fragments. In the first system, solutions of concentration of from 0 to 48 parts of anhydrous salt to 100 parts of water, on cooling and shaking, give crystals of ice or decahydrate at definite temperatures. These give rise to well-defined supersolubility curves intersecting in a "hypertectic" point at $-7{\cdot}6°$, and running roughly parallel to the corresponding solubility curves.

The solubility of the monohydrate has a negative temperature-coefficient, and saturated solutions therefore have to be warmed in order to bring about crystallisation of this salt. A supersolubility curve for this phase has been traced. At higher temperatures it becomes practically coincident with the solubility curve, since the latter is almost parallel to the temperature axis.

Of the fourteen possible solid phases which may separate out from solutions of sodium thiosulphate, only two, ice and the secondary monohydrate, give rise to definite supersolubility curves. When dilute solutions of concentrations between 0 and 40 parts anhydrous salt to 100 parts of water are slowly cooled and shaken, ice separates out at definite temperatures. With concentrated solutions between concentrations of 179 and 255, under the same conditions, the secondary monohydrate always appears at definite temperatures.

The spontaneous crystallisation of anhydrous salt, primary dihydrate, and primary and secondary pentahydrates has been observed in solutions kept at rest for long periods.

204. "The effect of contiguous unsaturated groups on optical activity. Part II. Acids containing two adjacent ethenoid groups." By Thomas Percy Hilditch. (Trans., 1909, 1570.)

An effort has been made to determine the effect of two conjugated ethylenic bands on the optical activity of an organic compound by means of the study of active esters and salts of acids containing this system, together with their reduction products. Derivatives of muconic, sorbic, piperic, cinnamylidenemalonic, and the corresponding $\alpha\beta$- and $\beta\gamma$-dihydro- and tetrahydro-acids have been examined in this way, with the following results:

(1) In all cases the compound possessing two contiguous ethenoid linkings shows a very marked optical exaltation with respect to either the monoethylenic or the fully saturated acids.

(2) As previously observed in other instances, the monoethylenic derivatives possess greater rotatory power than the saturated compounds, but the anomaly is of a much smaller order than that due to the conjugated system.

(3) The phenyl group in the δ-position with respect to carboxyl appears to exert a depressing influence on optical rotatory power.

(4) Adipic acid, although fully saturated, shows distinct exaltation of rotatory power in its optically active esters and salts.

(5) Muconic acid derivatives, possessing a structure symmetrical with respect to the centre of the conjugated system, show the most enhanced anomaly of all.

205. "The effect of contiguous unsaturated groups on optical activity. Part III. The normal series of fatty dibasic acids." By Thomas Percy Hilditch. (Trans., 1909, 1578.)

The dimenthyl esters and dibrucine salts of the acids from oxalic to sebacic inclusive have been prepared and examined polarimetrically in chloroform solution.

The oxalic derivatives show a very pronounced exaltation of optical activity; the malonic and succinic compounds show a depression below the normal value, similar to that previously noted in the case of formic and acetic acid compounds ; and, finally, adipic acid shows a distinct exaltation, although not so great as in oxalic acid. The glutaric compounds and derivatives of the higher acids are all approximately normal.

It is suggested that, whilst the anomaly in the case of oxalic acid is obviously due to the contiguity of two carboxyl groups, the cause of the enhanced values of dimenthyl and dibrucine adipates may be the contiguity of the carboxyl groups in space, which, according to the usually accepted stereochemical views, would occur in adipic acid and its derivatives.

206. "The formation at high temperatures of some refractory metals from their chlorides." By John Norman Pring and William Fielding. (Trans., 1909, 1497.)

The authors have investigated the reactions whereby some refractory metals can be prepared by exposing the vapour of their volatile chlorides to electrically heated carbon rods or filaments.

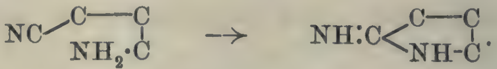
With tungsten chloride, used alone, under diminished pressure, decomposition took place in contact with the carbon rod at temperatures between 1200° and 1500°, and with molybdenum, below 1300°, forming adherent deposits on the rods of the pure metals. Above these temperatures the carbides resulted. In presence of small quantities of water vapour, the metals were always obtained free from the carbides.

Boron and silicon were obtained from their chlorides by exposing these together with hydrogen to the heated carbon rods. Pure crystalline silicon was obtained at temperatures between 1700° and 1850°. A thin protective layer of the carbide which first formed on the rod prevented carbonisation of the subsequent deposit, until, at a temperature of about 1900°, the carbide alone resulted.

With boron, the deposit always consisted of the carbide (B_6C), which was formed at temperatures between 1800° and 2000°. Some approximate photometric measurements were made on the radiating properties of the metal-coated rods. A very large increase in the luminosity for a given power-expenditure was observed with tungsten and molybdenum, amounting to about three times that of the carbon; whilst very little difference was produced by the deposits of silicon and boron carbide.

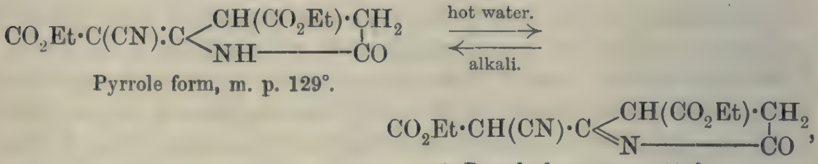
207. "The formation and rections of imino-compounds. Part X. The formation of imino-derivatives of pyrrole and of *iso*pyrrole from amino-nitriles." By Stanley Robert Best and Jocelyn Field Thorpe. (Trans., 1909, 1506.)

The authors have discovered that open-chain compounds having an amino-group in the γ-position with respect to a nitrile group, pass on treatment with sodium ethoxide into derivatives of pyrrole in accordance with the scheme:



$$\mathrm{NC}\!<\!\begin{array}{l}\mathrm{C{-}C}\\ \mathrm{NH_2\cdot C}\end{array} \longrightarrow \mathrm{NH{:}C}\!<\!\begin{array}{l}\mathrm{C{-}C}\\ \mathrm{NH{-}C}\end{array}.$$

It is also found that those ketones, derived from these imino-compounds, which have a carbon atom adjacent to the nitrogen, doubly linked outside the ring, tend readily to pass into the isomeric compound having the bond in the ring, the two compounds being mutually convertible the one into the other. This is shown by the following formulæ:

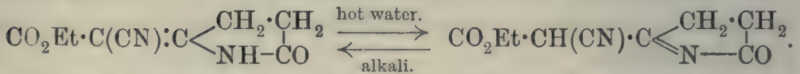


$$\mathrm{CO_2Et\cdot C(CN){:}C}\!<\!\begin{array}{l}\mathrm{CH(CO_2Et)\cdot CH_2}\\ \mathrm{NH{-}CO}\end{array} \underset{\text{alkali.}}{\overset{\text{hot water.}}{\rightleftarrows}} \mathrm{CO_2Et\cdot CH(CN)\cdot C}\!\leqslant\!\begin{array}{l}\mathrm{CH(CO_2Et)\cdot CH_2}\\ \mathrm{N{-}CO}\end{array},$$

Pyrrole form, m. p. 129°.

*iso*Pyrrole form, m. p. 109°.

and also



$$\mathrm{CO_2Et\cdot C(CN){:}C}\!<\!\begin{array}{l}\mathrm{CH_2\cdot CH_2}\\ \mathrm{NH{-}CO}\end{array} \underset{\text{alkali.}}{\overset{\text{hot water.}}{\rightleftarrows}} \mathrm{CO_2Et\cdot CH(CN)\cdot C}\!\leqslant\!\begin{array}{l}\mathrm{CH_2\cdot CH_2}\\ \mathrm{N{-}CO}\end{array}.$$

Pyrrole form, m. p. 181°. *iso*Pyrrole form, m. p. 145°.

208. "The atomic weight of chlorine."

By Robert Whytlaw Gray and Frank Playfair Burt.

(Trans., 1909, 1633.)

The value for the weight of a normal litre of hydrogen chloride resulting from twenty-one experiments is 1·63915 grams, Lat. 45°. The value previously published (*Proc.*, 1908, **24**, 215) was slightly too low.

Two volumes of hydrogen chloride, when decomposed by red-hot aluminium in a specially constructed apparatus, were found to yield 1·0079 volumes of hydrogen, the gases being measured at 0° and 760 mm. Eight experiments were made, and the maximum deviation was 1 part in 5000.

The atomic weight of chlorine calculated from these numbers, assuming that the atomic weight of hydrogen is 1·00762 (Morley) and that the density of hydrogen is 0·089873 gram per litre at 0° and 760 mm., Lat. 45°, is 35·459; O = 16.

The authors have also measured the form of the *pv* isothermal of hydrogen chloride at 0° between the pressure limits of 800 and 160 mm. The amounts of gas absorbed by the glass surfaces of the apparatus at different pressures were experimentally determined, and the observed *pv* values were corrected. Similar measurements with oxygen were also made in the same apparatus. Graphic extrapolation gave for the mean coefficient of compressibility between 1 and 0 atmosphere pressure at 0°:

for oxygen.................. $A'_0 = 0·000964$,
,, hydrogen chloride ... $A'_0 = 0·00748$,

for the molecular weight of hydrogen chloride on the oxygen standard, 36·469, and for the atomic weight of chlorine, 35·461. The value of the atomic weight resulting from the volumetric analysis, namely, 35·459, is thus confirmed.

It is hence concluded that 35·460 is a close approximation to the true atomic weight of chlorine.

209. "*iso*Quinoline derivatives. Part II. The constitution of the reduction products of papaverine." By Frank Lee Pyman.

(Trans., 1909, 1610.)

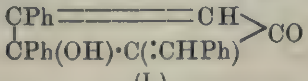
Goldschmiedt (*Monatsh.*, 1886, **7**, 485; 1898, **19**, 324) obtained by the reduction of papaverine a crystalline base melting at 200—201° which he termed "tetrahydropapaverine," together with an amorphous base from which no crystalline derivative was obtained.

The author has shown that this amorphous base is identical with the "*iso*tetrahydropapaverine" obtained by Freund and Beck (*Ber.*, 1904, **37**, 3321) by the reduction of papaveraldine, and is in reality *tetrahydropapaverine*. It forms crystalline salts of the formula $C_{20}H_{25}O_4N,HX$, and yields an N-*benzoyl* derivative, which gives on oxidation a new base, 6:7-*dimethoxy*-3:4-*dihydro*iso*quinoline*. The methochloride of this is identical with 6:7-dimethoxy-2-methyl-3:4-dihydro*iso*quinolinium chloride, a salt obtained by the action of hydrochloric acid on 4:5-dimethoxy-2-β-methylaminoethylbenzaldehyde (prepared by the oxidation of laudanosine: compare Pyman, *Trans.*, 1909, **95**, 1266). Further proof that the amorphous base is tetrahydropapaverine is afforded by the fact that it yields laudanosine on methylation.

Analyses of Goldschmiedt's so-called "tetrahydropapaverine" and its derivatives show that this base has the formula $C_{20}H_{23}O_4N$, and is in reality 1:2-*dihydropapaverine*.

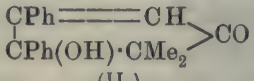
210. "Direct proofs of the presence of the hydroxyl group in derivatives of anhydroacetonebenzil." By Francis William Gray.

The author has succeeded in acetylating benzylideneanhydroacetonebenzil (I) and ββ-dimethylanhydroacetonebenzil (II) with acetic



$$\left.\begin{array}{l}\text{CPh}=\!=\!=\!=\!=\text{CH}\\ |\\ \text{CPh(OH)}\cdot\text{C(:CHPh)}\end{array}\right>\text{CO}$$

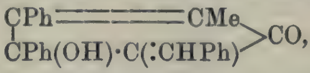
(I.)



$$\left.\begin{array}{l}\text{CPh}=\!=\!=\text{CH}\\ |\\ \text{CPh(OH)}\cdot\text{CMe}_2\end{array}\right>\text{CO}$$

(II.)

anhydride containing sulphuric acid. For the formation of an acetyl derivative of the anhydroacetonebenzil series, it is essential that both hydrogen atoms of the methylene group should be displaced, but in the case of benzylidene-α-methylanhydroacetonebenzil,



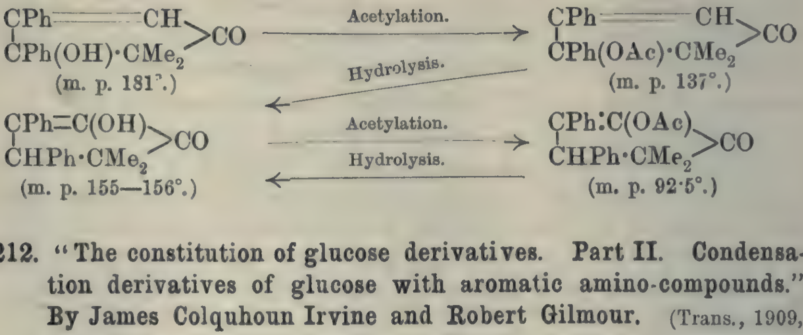
$$\left.\begin{array}{l}\text{CPh}=\!=\!=\!=\!=\text{CMe}\\ |\\ \text{CPh(OH)}\cdot\text{C(:CHPh)}\end{array}\right>\text{CO},$$

no acetyl compound but a dehydration derivative is obtained.

Direct proof of the presence of the hydroxyl group in α-methylanhydroacetonebenzil and in benzylidene-α-methylanhydroacetonebenzil was afforded by the preparation of their ethyl ethers. The conclusion is drawn, that ethyl ethers can be obtained by the method used (boiling with ethyl alcohol and sulphuric acid) only with compounds in which the hydrogen atom of the CH group of anhydroacetonebenzil is displaced by a methyl group.

211. "Isomerides of anhydroacetonebenzil and its derivatives." By Francis William Gray.

The acetyl derivatives of ββ-dimethylanhydroacetonebenzil and benzylideneanhydroacetonebenzil (see preceding paper) on hydrolysis give isomerides of these compounds. The reactions may be represented as follows:



$$\left.\begin{array}{l}\text{CPh}=\!=\!=\text{CH}\\ |\\ \text{CPh(OH)}\cdot\text{CMe}_2\end{array}\right>\text{CO}\ \text{(m. p. 181°.)}\xrightarrow{\text{Acetylation.}}\left.\begin{array}{l}\text{CPh}=\!=\!=\text{CH}\\ |\\ \text{CPh(OAc)}\cdot\text{CMe}_2\end{array}\right>\text{CO}\ \text{(m. p. 137°.)}$$

$$\left.\begin{array}{l}\text{CPh}=\text{C(OH)}\\ |\\ \text{CHPh}\cdot\text{CMe}_2\end{array}\right>\text{CO}\ \text{(m. p. 155—156°.)}\ \underset{\text{Hydrolysis.}}{\overset{\text{Acetylation.}}{\rightleftarrows}}\ \left.\begin{array}{l}\text{CPh:C(OAc)}\\ |\\ \text{CHPh}\cdot\text{CMe}_2\end{array}\right>\text{CO}\ \text{(m. p. 92·5°.)}$$

212. "The constitution of glucose derivatives. Part II. Condensation derivatives of glucose with aromatic amino-compounds." By James Colquhoun Irvine and Robert Gilmour. (Trans., 1909, 1545.)

In continuing their previous work (*Trans.*, 1908, **93**, 1429) on the constitution of sugar derivatives, the authors have condensed glucose with a number of aromatic amino-compounds, obtaining mutarotatory stereoisomeric forms of glucose-*p*-toluidide, glucose-*β*-naphthylamide, glucose-*p*-phenetidide, and glucose-*o*-carboxyanilide.

The compounds mentioned undergo mutarotation comparable in every way with that shown by glucoseanilide, for which the *γ*-oxidic structure has been established by a synthetical method. The results indicate that all the compounds must be similarly constituted, and that, so far as the cases examined are concerned, the normal condensation of glucose with amino-acids or bases consists in the elimination of water from the amino-group and the hydroxyl group attached to the terminal carbon atom of the sugar molecule.

The following compounds were isolated in pure stereochemical forms:

*α-Glucose-*p*-toluidide*: anhydrous prisms, $[\alpha]_D^{20}$ $+181\cdot9° \longrightarrow -45\cdot0$.

*β-Glucose-*p*-toluidide*: needles containing $1H_2O$, $[\alpha]_D^{20}$ $-97\cdot6° \longrightarrow -45\cdot2$; plates containing $\frac{1}{2}H_2O$, $[\alpha]_D^{20}$ $-94\cdot6° \longrightarrow -47\cdot3$.

*β-Glucose-*p*-phenetidide*: needles containing $1H_2O$, $[\alpha]_D^{20}$ $-96\cdot1° \longrightarrow -38\cdot3$.

β-Glucose-β-naphthylamide: needles containing $1H_2O$, $[\alpha]_D^{20}$ $-118\cdot7° \longrightarrow -48\cdot1$.

*α-Glucose-*o*-carboxyanilide*: needles containing $1H_2O$, $[\alpha]_D^{20}$ $+87\cdot4° \longrightarrow +14\cdot5$.

213. "The relation between viscosity and chemical constitution. Part IV. Viscosity and hydration in solution." By Albert Ernest Dunstan and Ferdinand Bernard Thole. (Trans., 1909, 1556.)

The authors have determined the viscosity-concentration curves for the binary systems composed of water and methyl, ethyl, and propyl alcohols, and acetic acid respectively at different temperatures. They confirm the results of previous investigators, and discuss the nature of the mixtures of maximum viscosity, particularly with respect to the temperature-coefficient of viscosity.

214. "Some derivatives of *l*-benzoin." By Henry Wren.

(Trans., 1909, 1583.)

d-Mandelamide and *d*-benzoin have been isolated and found to agree in their properties with *l*-mandelamide and *l*-benzoin. A number of optically active derivatives of *l*-benzoin have also been prepared.

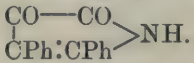
215. "Racemisation phenomena observed in the study of *l*-benzoin and its derivatives." By Henry Wren. (Trans., 1909, 1593.)

It has been shown that *l*-benzoin and its methyl ether readily racemise under the action of potassium hydroxide or sodium ethoxide, this being probably due to a desmotropic change within the molecule. *l*-Benzoin ethyl ether was found to be partly, and carbanilido-*l*-benzoin completely, racemised by heat, whilst under the action of benzoyl chloride at a rather high temperature, of aniline at 100°, and of a saturated solution of hydrogen chloride in alcohol at a temperature not exceeding 40°, *l*-benzoin has been converted into derivatives of *r*-benzoin.

Finally, methyl *l*-mandelate has been found to undergo partial racemisation during its conversion into *l*-mandelamide by the action of alcoholic ammonia. The acetylation of *l*-benzoin-α-oxime has also been effected.

216. "Diketodiphenylpyrroline and its analogues." By Siegfried Ruhemann. (Trans., 1909, 1603.)

The author has continued his work on the interaction of the sodium derivatives of aromatic amides with ethyl phenylpropiolate (*Trans.*, 1909, **95**, 984), and has prepared a number of analogues of diketodiphenylpyrroline,



$\left.\begin{array}{l}\text{CO}\text{---}\text{CO}\\ |\\ \text{CPh}\vdots\text{CPh}\end{array}\right>\text{NH}$. These substances have a deep colour, which varies from dark red to brown and black, and have the property in common that they dissolve in dilute alkalis to yield blue solutions, which, however, rapidly turn yellow. They resemble, therefore, isatin, and, like this form, phenylhydrazones and oximes.

In this connexion the author has examined the behaviour of phenylcarbamide and *p*-tolylcarbamide towards ethyl phenylpropiolate, and has found that this reaction, unlike that in which carbamide is used, does not give rise to cyclic compounds, but colourless acyl derivatives of carbamide, for example, phenylpropiolylphenylcarbamide, $C_6H_5\cdot C\vdots C\cdot CO\cdot NH\cdot CO\cdot NH\cdot C_6H_5$.

217. "The synthesis of acridines: tetramethylacridines, dimethylnaphthacridines, naphthaquinacridines, diquinacridines." By Alfred Senier and Arthur Compton. (Trans., 1909, 1623.)

By further employment of the methods described in a previous paper (*Trans.*, 1907, **91**, 1927), the authors have obtained 2 : 3 : 7 : 8-*tetramethylacridine*, and also the corresponding 9:10-*dimethylpheno*-$\begin{array}{l}\text{N-}\beta\\ |\\ \text{CH-}\alpha\end{array}$-*naphthacridine* and 9 : 10-*dimethylpheno*-$\begin{array}{l}\text{N-}\alpha\\ |\\ \text{CH-}\beta\end{array}$-*naphthacridine*. The chief object of this inquiry, however, was to prepare acridines with heterocyclic wings, and three heterocyclic acridines, namely, $\begin{array}{l}\text{6-N-6}\\ \;\;\;|\\ \text{5-CH-5}\end{array}$-*diquinacridine*, $\begin{array}{l}\alpha\text{-N-6}\\ \;\;\;|\\ \beta\text{-C-5}\end{array}$-*naphthaquinacridine*, and $\begin{array}{l}\beta\text{-N-6}\\ \;\;\;|\\ \alpha\text{-CH-5}\end{array}$-*naphthaquinacridine*, have been isolated by the use of aminoquinolines.

The diquinacridine described is the first known member of a group of twenty-one possible isomeric diquinacridines derived from ordinary quinoline, and, similarly, the two naphthaquinacridines belong to a group of heterocyclic acridines of which eighteen members are theoretically possible.

All these compounds, containing as they do the acridine fluorphoric group, exhibit marked fluorescence. When dissolved in the usual organic solvents, the ultraviolet waves are so reduced in refrangibility that they appear in the blue, whereas in solution in glacial acetic or concentrated sulphuric acids they are reduced as far as the green, or even yellowish-green, portion of the spectrum.

Thursday, October 21st, 1909, at 8.30 p.m., Professor HAROLD B. DIXON, F.R.S., President, in the Chair.

Messrs. D. F. Blyther and G. J. Woods were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Jehangir Dhanjishaw Anklesaria, Ahmedabad, India.
James Alexander Hadden Armstrong, Dumisa, Natal.
Donald William Elsom Barker, 2, Hope Street, Wrexham.
Harold Baron, B.Sc., 21, Underhill Road, East Dulwich, S.E.
Stanley Robert Best, M.Sc., Hope Villa, Wellington Road, Whalley Range, Manchester.
Hubert Frederick Bottomley, The Cedars, Wavertree Road, South Woodford.
Henry Shaw Breakspear, B.A., 20, Walton Well Road, Oxford.
Oskar K. H. Burger, Ph.D., 4, Mission Row, Calcutta.
Frank Ward Bury, B.Sc., Lyndale Cottage, Darwen.
William Edward Callister, B.Sc., The Rowans, Onchan, I.O.M.
William Gordon Carey, Wyngarth, Harpenden.
Lakshami Chand, B.A., B.Sc., c/o Messrs. Ramchand and Bulaki Nandan Sahni Street, Benares, U.P., India.
James Ferguson Dawson, B.Sc., Glencoe House, Tarbert, Loch Fyne, N.B.
Alfred Charles Dunningham, B.Sc., 28, Victoria Road, Northwich.
Edward Charles Edgar, D.Sc., Dalegarth, Romiley, Cheshire.
Alfred Edge, Ravenhurst, Clayton Bridge, Manchester.

Frederick Watson Edwards, 64, Coppice Side, Swadlincote.
Arthur James Ewins, B.Sc., 7, Towton Road, West Norwood, S.E.
George Peters Forrester, 69, Beck Strasse, Darmstadt.
William Adolf Freymuth, Rangoon, Burma.
Otto Fürstenhagen, 28, Schlesische Strasse, Berlin.
George Pomeroy Furneaux, B.A., Harbour View, Brixham, S. Devon.
Henry Dent Gardner, jun., M.Sc., Fairmead, The Goffs, Eastbourne.
Victor John Harding, M.Sc., Lonsdale Terrace, Whitefield, Manchester.
Arthur John Harvey, 88a, East India Dock Road, Poplar, E.
Robert Douglas Hendry, 3, Glebe Terrace, Alloa.
William Cudmore McCullagh Lewis, M.A., Garmoyle, Bangor, Ireland.
Carl Olof Lundholm, 2, Eton Avenue, Hampstead, N.W.
Roland Victor Norris, M.Sc., 1, Howe Street, Higher Broughton, Manchester.
Charles Proud, 12, Chancellor Road, Southend-on-Sea.
Walter Ritchings, M.Sc., 89, Rosehill Road, Burnley.
Pindi Das Sabherwal, Bhera, Punjab.
Manindra Sinha, B.A., St. Xavier's College, Calcutta.
Spencer Boyd Cortis Stanford, Glenwood, Dalmuir, Dumbartonshire.
Guy Stephenson, Alexandra Terrace, Crook, Co. Durham.
George Bertram Stones, M.Sc., Bank Villas, Tyldesley, nr. Manchester.
James Thallon Strachan, 10, Nelson Street, Sunderland.
Hubert Sanderson Tasker, B.A., Emmanuel College, Cambridge.
Joseph Grantley Tingle, Nauru, Marshall Islands, Central Pacific.
Henry Thomas Tizard, B.A., 23, Geneva Road, Kingston-on-Thames.
Herbert Turner, B.Sc., 217, Middleton Street, Moss Side, Manchester.
Nikolai Waliaschko, Hohenzollernstr, 12, II, 1, Leipzig.
Charles Weizmann, Ph.D., D.Sc., 57, Birchfields Road, Rusholme, Manchester.
Herbert Ernest Williams, 70, Wellington Road, Charlton, Kent.
Roland Francis Young, c/o Taquah Mining and Exploration Co., Tarkwa, Gold Coast.

Professor WILLIAM A. TILDEN, D.Sc., F.R.S., then delivered the Mendeléeff Memorial Lecture, at the conclusion of which a vote of thanks was proposed by Sir EDWARD THORPE, C.B., F.R.S., seconded by Sir WILLIAM RAMSAY, K.C.B., F.R.S., and carried by acclamation.

218. "Carthamine." (Preliminary note.)

By T. Kametaka and Arthur George Perkin.

Carthamine, the red colouring matter of safflower (*Carthamus tinctoria*), was first isolated by Schlieper (*Annalen*, 1846, **58**, 362) as a red, amorphous powder possessing a cantharides iridescence, and to this he assigned the formula $C_{14}H_{16}O_7$. Radcliffe (*J. Soc. Dyers*, 1897, **13**, 158) obtained carthamine from safflower extract as red, iridescent needles melting at 168—169° (provisional), but did not analyse this product. The authors corroborate the work of Radcliffe, but regard the compound he prepared as a salt of carthamine, rather than the free colouring matter itself. They find that the crystalline substance is most readily obtained from the extract by means of pyridine and water, but that an elaborate purification is necessary to obtain a pure compound free from calcium, magnesium, and potassium salts. It forms red, iridescent needles, which, when dried at 110°, are exceedingly hygroscopic and are decomposed at about 228—230°. Analyses indicate that the formula of carthamine is probably $C_{15}H_{14}O_7$ (Found: $C = 58{\cdot}16$; $H = 4{\cdot}87$). On fusion with potassium hydroxide, carthamine gives *p*-hydroxybenzoic acid, as stated by Malin (*Annalen*, 1865, **136**, 117), but in the pure condition the dyestuff appears to be much more stable than has been previously suggested.

219. "A theory regarding the configuration of certain unsaturated compounds; and its application to the metallic ammines and the cinnamic acids." By Sarah Martha Baker.

According to the author's theory, if there is sufficient attraction between the other atoms joined to a nitrogen atom and that to which it is doubly bound, there are two possible isomerides, namely, the "*en*" isomeride, in which the other atoms are grouped round the double bond, and the "*ex*" or symmetrical isomeride. This theory has been extended to phosphorus, sulphur, and finally, in rare cases, to carbon compounds.

To represent the metallic ammines, it is assumed that the ionisable acid groups are connected to the metal through a chain of one or more $\cdot NH_3 \cdot$ groups; but that the non-ionisable acid groups are directly joined to the metal, and, in most cases, prevented from undergoing ionisation by having an NH_3 group also attached, thus: $\cdot M \cdot X \vdots NH_3$. Wherever the grouping $\cdot X \vdots NH_3$ occurs there is a possibility of isomerism. An attempt was made to deduce the configuration of the *flavo*- and *croceo*-cobalt salts in terms of this theory.

Applying the same principles to the three cinnamic acids, it was shown that, if ordinary cinnamic acid is represented as "*ex*" fumaroid, *iso*cinnamic acid as "*ex*" maleoid, and *allo*cinnamic acid as "*en*" maleoid cinnamic acid, many of the anomalies in their behaviour are explicable.

220. "The relation between the chemical constitution of monoazo-dyes and their fastness to light." By Edwin Roy Watson.

The author puts forward the theory that the fading in light of an azo-dye is due to the oxidation of that part of the molecule which contains hydroxy- or amino-groups, and that the fastness of such a dye is increased by introducing into the phenolic or arylamino-part such other groups as will reduce the tendency to become oxidised.

221. "The influence of gaseous oxides of nitrogen on the rate of interaction of chlorine and hydrogen." By David Leonard Chapman and Patrick Sarsfield MacMahon.

It was shown that the brown gas resulting from the interaction of nitric oxide and chlorine—presumably nitrogen peroxide—inhibits the union of hydrogen and chlorine in the light. The inhibitor is slowly absorbed by the chlorine water in the actinometer, and as it is removed the electrolytic gas gradually recovers its original sensitiveness; the removal of the last trace of inhibitor appears to be facilitated by the action of light.

The retardation observed with nitrous oxide was so small that the authors conclude that this gas behaves as a diluent only. In this respect it resembles nitrogen and carbon dioxide.

222. "Estimation of small quantities of ferrous iron by potassium permanganate in the presence of hydrogen chloride." By John Albert Newton Friend.

The author has recently shown (*Trans.*, 1909, **95**, 1228) that, if certain precautions are rigidly observed, ferrous iron may be accurately estimated by titration with $N/10$-permanganate in the presence of any concentration of hydrogen chloride not exceeding $m/4$. Experiments have now been performed in a similar manner with $N/25$-permanganate and correspondingly smaller quantities of iron. The results are given in the table, the volume titrated being in each case 200 c.c.:

			0·5 gram $MnSO_4,5H_2O$.		1·0 gram $MnSO_4,5H_2O$.		2·0 grams $MnSO_4,5H_2O$.	
Concentration of hydrogen chloride.	Titre in c.c. $KMnO_4$.	Error, c.c.	Titre in c.c. $KMnO_4$.	Error, c.c.	Titre in c.c. $KMnO_4$.	Error, c.c.	Titre in c.c. $KMnO_4$.	Error, c.c.
m/∞ ..	23·58	—	23·48	—	23·78	—	23·78	—
$m/8$ ..	23·86	0·28	23·52	0·04	23·79	0·01	23·78	0·00
$m/4$ ..	23·90	0·32	23·57	0·09	23·83	0·05	23·80	0·02
$3m/8$..	23·96	0·38	23·60	0·12	23·87	0·09	23·85	0·07
$m/2$ ..	24·12	0·54	23·80	0·32	23·93	0·15	23·88	0·10

The most satisfactory titrations were those obtained in the presence of from 1 to 2 grams of manganous sulphate, when the concentration of the hydrogen chloride did not exceed $m/4$. In general it was found that 1 gram of manganous sulphate was preferable to 2 grams, as, in the latter case, the end-point is less permanent, and with larger quantities is fugitive and therefore uncertain. As the presence of manganous sulphate slightly affects the value of the titration of ferrous sulphate in the absence of hydrogen chloride, it is important to standardise the permanganate with ferrous sulphate in the presence of the same amount of manganous sulphate as will be used in the hydrogen chloride solution.

The chief difficulty is to recognise the end-point, but with a little practice results sufficiently accurate for most purposes can be obtained in daylight, as is evident from a consideration of the above table. Commercial permanganate gave equally good results as the specially pure salt.

223. "The mutarotation of glucose and its nitrogen derivatives."

By Robert Gilmour.

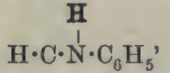
The author showed that the optical behaviour of the glucosephenylhydrazones (Behrend and Lohr, *Annalen*, 1903, **362**, 78) brings them into line with glucose-anilide, *p*-toluidide, and other similar compounds which possess the γ-oxidic structure.

On the analogy of the relationship between the specific rotations of the glucoses and the methylglucosides, the value for α-glucose-*p*-toluidide can be calculated (α_D +226°), and the calculated value is not widely different from the value found experimentally (α_D +181°). The values for α-glucose-*p*-phenetidide and -β-naphthylamide have been similarly calculated. The fact that tetramethyl glucoseanilide has the rotation α_D +224° lends support to the idea that α-glucoseanilide has also a high dextrorotation, since it is known that the introduction of four methoxyl groups into the glucose residue has little effect on the optical rotatory power.

It is suggested that the glucosephenylhydrazones possess the γ-oxidic structure, and should thus exist in not more than two stereoisomeric interconvertible forms, having rotations of $\alpha_D + 224°$ and $-87°$ respectively.

The author considers that the mutarotation of glucose and its nitrogen derivatives is due to the presence of a labile hydrogen atom (shown in heavy type) which is not directly united to carbon,

$H\cdot C\cdot O\cdot \mathbf{H}$



$H\cdot C\cdot \overset{\mathbf{H}}{\overset{|}{N}}\cdot C_6H_5$,

and that the change occurs through the intermediate formation of an unstable aldehydic form. It seems probable that, under ordinary conditions, the γ-oxidic form of glucoseoxime is the more stable; but that under a particular set of conditions, the aldehydic form may be the more stable.

224. "The solubility of bismuth trisulphide in alkali sulphides and of bismuth trioxide in alkali hydroxides." By Joseph Knox.

The author finds that dried precipitated bismuth sulphide dissolves in solutions of both sodium and potassium sulphides, and that the solubility increases rapidly with the concentration of the alkali sulphide. The solubility in potassium sulphide is rather greater than in sodium sulphide of the same concentration. The addition of alkali hydroxides to the alkali sulphide solutions greatly increases the solubility of bismuth sulphide. In a solution of sodium disulphide the solubility of bismuth sulphide is about one-third of that in the corresponding strength of the monosulphide, whilst in solutions of ammonium sulphide and of alkali hydrosulphides and hydroxides, bismuth sulphide is insoluble.

From these facts it is shown that the solubility of bismuth sulphide in alkali sulphide solutions must depend on the formation of a complex anion with the sulphur ion of these solutions.

Bismuth trioxide dissolves to a slight extent in alkali hydroxides, the solubility being approximately proportional to the concentration of the alkali hydroxide. Towards strong bases it therefore behaves as the anhydride of a weak acid, but to a much less extent than the corresponding oxides of arsenic and antimony.

225. "Substituted amides of tartaric acid."

By Kate Maud Jackson and Allen Neville.

The following new substituted amides of tartaric acid have been obtained, and as some of them illustrate the influence of constitution on the rotatory power of substances, their specific rotations are recorded.

Two determinations of the rotatory power of each substance were made, 1 per cent. solutions in pyridine being used:

	Melting point.	$[\alpha]_D^{15°}$.	$[M]_D^{15°}$.
Tartarodi-o-*anisidide*	180°	155·71	558·25
		155·83	560·78
Tartarodi-p-*anisidide*	about 250 (with decomposition)	205·80	740·88
		203·60	732·96
Tartarodi-p-*xylidide*	209°	148·87	529·97
		149·61	532·61
Tartarodi-m-4-*xylidide*	179	201·16	716·12
		199·98	711·93
Tartarodi-ψ-*cumidide*	240 (with decomposition)	168·42	646·73
		168·66	647·65

The substances were in all cases prepared from ethyl tartrate and the amine by heating to about 150° on an oil-bath for several hours. It will be seen that, in the case of the anisidides and xylidides, as in the case of similar isomeric compounds described by Frankland and Slator (*Trans.*, 1903, **83**, 1349), the effect of constitution is very marked. In the case of para- and ortho-compounds, the para has here, as in previously-described compounds, the higher rotatory power, whilst in the xylidides the *m*-4-compound has a considerably greater rotatory power than the *p*-compound.

Attempts have been made to prepare similar compounds from the different nitroanilines, but so far without success.

226. "A volumetric process for the estimation of tungsten." By Edmund Knecht and Eva Hibbert.

The process is based in the first instance on the well-known fact that tungstic acid is reduced by zinc and hydrochloric acid to tungsten dioxide, which, in presence of excess of acid, yields a clear light brown solution. If now a solution of a ferric salt be added, the dioxide is oxidised to the trioxide. The end-point is perceived by the disappearance of the intense blue colour of the intermediate compound corresponding with tungsten pentachloride, the reaction

$$Fe_2O_3 + WO_2 = 2FeO + WO_3$$

being quantitative. It is thus possible to estimate tungsten volumetrically in presence of iron. Potassium thiocyanate may also serve as indicator, but does not offer any particular advantage.

227. "The volumetric estimation of mercury, and the estimation of silver in presence of mercury." By Joseph Knox.

The thiocyanate method of Rupp and Kraus (*Ber.*, 1902, **35**, 2015) for the estimation of mercury in a solution of mercuric nitrate has been tested, and found to be both rapid and accurate.

The author showed that the estimation of silver by Gay-Lussac's method in presence of mercuric nitrate (by Rupp and Kraus' method) is impracticable, and described a volumetric method which depends on the solubility of silver chloride in potassium cyanide, but the gravimetric estimation of the silver is recommended as being more accurate and convenient. The accuracy of the latter method has been proved in a considerable number of determinations, in which the quantity of mercuric nitrate present was varied greatly.

228. "The rapid electro-analytical deposition and separation of metals. Part III." (Preliminary note.) By Henry Julius Salomon Sand.

A method for the analysis of alloys of copper and tin by electrolysis has been described by A. Fischer (*Zeitsch. Elektrochem.*, 1909, **15**, 591), in which an acid tartrate solution is employed in a similar manner as in the copper–bismuth separation given by the author (Trans., 1907, **91**, 395). It is stated by Fischer that the tin exerts a retarding influence on the copper, necessitating a higher potential for the complete deposition of the latter than in solutions from which tin is absent. In the experiments now described, however, no retarding action due to the tin has been observed. The copper may be precipitated completely from boiling solutions at an auxiliary potential of 0·60 volt, just as in the absence of tin. On the other hand, when chlorides are present, these exert a retarding influence varying with the amount of the chloride. This is due to the intermediate production by the current of more or less complex, very slightly dissociated cuprous compounds, which require a high potential for their reduction. The explanation of Fischer's result is to be sought, not in the presence of the tin, but in the fact that it was added by him as stannic ammonium chloride.

The author has separated copper from antimony under similar conditions to those employed for bismuth. The antimony should be present for the greater part in the antimonic state. In the analysis of an alloy, a suitable solution is obtained by employing a hot mixture of dilute nitric and tartaric acids as a solvent, and afterwards neutralising the free mineral acid.

229. "Some mercury derivatives of camphor."
By James Ernest Marsh and Robert de Jersey Fleming Struthers.

A detailed description was given of work of which a preliminary account has already appeared (*Proc.*, 1907, **23**, 246; 1908, **24**, 267).

230. "The reduction of perchlorates by titanous salts."

By Edmund Knecht.

In a recent paper by Rothmund, the reduction of perchlorates by titanous sulphate is discussed, and a method is described for the quantitative estimation of perchlorates, which is based on the complete reduction of the perchlorate by titanous sulphate, followed by the estimation of the resulting chloride by Volhard's process. Rothmund states that it should be possible to effect the estimation of perchlorates by ascertaining, by titration with iron alum, the amount of titanous sulphate that has been oxidised, but no experimental data are given.

Criticising Rothmund's results, Stähler maintains that the latter procedure is liable to give rise to serious errors, since, according to his finding, boiling alone is sufficient to convert some of the titanous into titanic salt.

It is now shown that, under suitable conditions, accurate results can be obtained by first reducing the perchlorate with titanous chloride, and then titrating back with standard iron alum, using potassium thiocyanate as indicator. For the successful carrying out of the titration, it is necessary to use the titanous chloride in a concentrated form and to acidify strongly with a mixture of sulphuric and oxalic acids.

231. "Further syntheses of *p*-hydroxyphenylethylamine."

By George Barger and George Stanley Walpole.

The isolation of *p*-hydroxyphenylethylamine,

$$OH{\cdot}C_6H_4{\cdot}CH_2{\cdot}CH_2{\cdot}NH_2,$$

an active principle of ergot, was recently described (Barger, *Trans.*, 1909, **95**, 1123), together with its preparation by the reduction of *p*-hydroxyphenylacetonitrile; two other syntheses have now been carried out.

First, benzoylphenylethylamine, $C_6H_5{\cdot}CH_2{\cdot}CH_2{\cdot}NHBz$, is nitrated, the *p*-nitro-compound is reduced, the amino-compound converted into the hydroxy-compound by the diazo-reaction, and the benzoyl group is finally removed by heating with acids; instead of the benzoyl, the corresponding acetyl and benzylidene derivatives may be employed.

Secondly, *p*-methoxyphenylpropionamide,

$$MeO{\cdot}C_6H_4{\cdot}CH_2{\cdot}CH_2{\cdot}CO{\cdot}NH_2,$$

is prepared from anisaldehyde; Hofmann's reaction then furnishes *p*-methoxyphenylethylamine, from which the methyl group is eliminated by heating with acids.

A number of intermediate compounds were also described.

232. "The constitution of hydroxyazo-compounds. Part II."
By William Bradshaw Tuck.

The absorption spectra of the *o*-hydroxyazo-compounds and their ethers have been compared with ortho-substituted phenols in which the substituting group contains a double bond in a position analogous to the double bond in the hydroxyazo-compounds. The effect of progressively increasing the degree of unsaturation attached to the azo-benzene nucleus has been investigated. The results obtained confirm the conclusions previously arrived at, and also indicate the reason for the apparently large difference between the absorption spectra of hydroxyazo-compounds and those of their sodium salts.

233. "Optically active substances containing no asymmetric atom. 1-Methyl*cyclo*hexylidene-4-acetic acid." By William Henry Perkin, William Jackson Pope, and Otto Wallach.

A detailed description was given of work of which a preliminary account has already appeared (this vol., 83).

234. "*iso*Quinoline derivatives. Part III. The oxidation of substituted 1-benzyltetrahydro*iso*quinolines." By Frank Lee Pyman.

The results obtained by the oxidation of narcotine, hydrastine, laudanosine, *N*-benzoyltetrahydropapaverine, tetrahydropapaverine, N-*ethyltetrahydropapaverine*, N-*propyltetrahydropapaverine*, 1-benzylhydrocotarnine, 1-ethylhydrocotarnine, 1-propylhydrocotarnine, and 1-benzyl-2-methyltetrahydro*iso*quinoline appear to justify the following general conclusions:

(1) That substituted 1-benzyltetrahydro*iso*quinolines suffer oxidation and fission simultaneously under the influence of hot dilute sulphuric acid and manganese dioxide, yielding the aldehyde corresponding with the substituted benzyl group, and a basic degradation product.

(2) That in the case of substituted 1-benzyl-2-alkyltetrahydro*iso*quinolines, the basic product is a substituted 2-β-alkylaminoethylbenzaldehyde, which yields salts of the corresponding 2-alkyl-3:4-dihydro*iso*quinolinium hydroxide.

(3) That in the case of substituted 1-benzyl-2-acyltetrahydro*iso*quinolines, and 1-benzyltetrahydro*iso*quinolines containing a free imino-group, the basic product is a substituted 3 : 4-dihydro*iso*quinoline.

(4) That substituted 1-alkyltetrahydro*iso*quinolines do not undergo this type of change.

235. "Contributions to the theory of solutions."
By John Holmes and Philip John Sageman.

The authors have investigated the changes in volume which occur on mixing methyl iodide with ethyl alcohol, *n*-propyl alcohol, and acetone. The conclusion is drawn that acetone is aggregated in a similar manner to the *n*-primary alcohols, and that methyl iodide possesses twice this complexity; this conclusion receives support from the proportions of methyl iodide in admixture with the lower primary alcohols which exhibit a maximum absorption of heat. Aniline and ethyl acetate are also found to be aggregated similarly to the *n*-primary alcohols.

It is found that the change in volume produced on gradually neutralising a base with an acid is directly proportional to the quantity of salt formed.

The results of the investigation tend to the conclusion that physical forces only are operative in solution, and that theories requiring electrolytic dissociation or combination of solvent with solute are unnecessary for understanding many of the phenomena common to aqueous and non-aqueous mixtures.

236. "The constitution of polynitrophenols in alkaline solution."
By Bertram Haward Buttle and John Theodore Hewitt.

The absorption spectra of 2 : 4- and 2 : 6-dinitrophenols in acid and alkaline solution have been examined, and whilst the latter gives solutions showing absorptions similar to those of *o*-nitrophenol, solutions of the 2 : 4-isomeride show more resemblance to *p*-nitrophenol. The conclusion is thus drawn that 2 : 4-dinitrophenol gives para- rather than ortho-quinonoid salts.

Picric acid, being a very strong acid, is nearly completely ionised in dilute aqueous solution, the absorption spectrum produced by an aqueous solution of the acid being practically identical with that of the sodium salt, but differs very markedly from that given by 2 : 4 : 6-trinitroanisole.

Attention was drawn to the influence exerted on nitro-groups attached to aromatic nuclei by other nitro-groups in the meta-position.

237. "The preparation of disulphides. Part VII. The nitrobenzyl mercaptans and disulphides." By Thomas Slater Price and Douglas Frank Twiss.

By the hydrolysis of the three sodium alkyl thiosulphate compounds, the corresponding *o*-, *m*-, and *p*-nitrobenzyl mercaptans have been prepared. By oxidation with iodine the corresponding disulphides were obtained. The properties of the disulphides prepared in this way agree with those of the compounds obtained by the action of alkali on the sodium nitrobenzyl thiosulphates (*Trans.*, 1908, **93**, 1402).

The method of preparation of *p*-nitrobenzyl disulphide given by Strakosch (*Ber.*, 1872, **5**, 692) was investigated and shown to yield a mixture of the monosulphide, disulphide, and mercaptan. The substance described by Strakosch as the disulphide appears to have been a mixture of the disulphide and mercaptan, and the compound described by him as the mercaptan was really the impure monosulphide.

The melting points of the nitrobenzyl mercaptans are: ortho, 29·5°; meta, 14°; and para, 52·5°. These are slightly different from those given by previous observers, the discrepancies being probably due to traces of disulphide in the mercaptans previously obtained.

Gutmann's recent results (*Ber.*, 1909, **42**, 228) on the action of acids on sodium and potassium ethyl thiosulphates were discussed, and shown to be in accordance with the usually accepted constitutional formula for sodium thiosulphate.

238. "A colorimetric method for the estimation of small quantities of vanadium." By Arnold William Gregory.

The method is based on the colour reaction which takes place when a solution of vanadium in concentrated sulphuric acid is added to a solution of strychnine in the same acid. A violet colour is first formed, and this changes to orange. As the latter colour is quite permanent, and is proportional to the quantity of vanadium present, a comparison of the colour produced with that given by a known amount of vanadium under similar conditions indicates the amount of vanadium present in the solution tested. This test is not given by titanium, tungsten, or molybdenum, nor does their presence in relatively large quantities interfere with the formation of the colour given by vanadium. The presence of iron interferes with the reaction. This element must therefore be removed before the test can be applied.

239. "Chlorination and bromination of acylanilides. A direct process." (Preliminary note.) By Kennedy Joseph Previté Orton and William Jacob Jones.

In the chlorination (or bromination) of acylanilides, the chloroamines, $Ar{\cdot}NCl{\cdot}Ac$, are not intermediate steps, in the sense that they are first formed, and then change by an intramolecular rearrangement into the chloroacylanilides. The substitution of hydrogen in the benzene nucleus of anilides is rather the result of a direct interaction of chlorine (or bromine) and anilide. In the conversion of a chloroamine into the isomeric anilide under the influence of hydrochloric acid, the presence of which is essential, the chloroamine first reacts with hydrochloric acid, thus: $Ar{\cdot}NCl{\cdot}Ac + HCl \rightleftarrows Ar{\cdot}NH{\cdot}Ac + Cl_2$ (Orton and Jones, Trans., 1909, **95**, 1456); then the free chlorine and the anilide interact.

Among the mass of evidence which the authors have accumulated in favour of the above statement, the following will serve as an illustration. In a solution of acetylchloroamino-*p*-chlorobenzene and hydrochloric acid (concentration of each = 0·025 gram-molecules per litre) in 50 per cent. acetic acid, in which about 1·2 per cent. of the total chlorine is free, the formation of 2 : 4-dichloroacetanilide is about twice as rapid as the formation of *p*-(and *o*-)chloroacetanilide in a similar equimolecular system composed of acetylchloroaminobenzene and hydrochloric acid, in which only a trace of free chlorine is found. Yet in a system composed of acetylchloroamino-*p*-chlorobenzene, acetanilide, and hydrochloric acid in the same medium, the acetanilide only is chlorinated; *o*- and *p*-chloroacetanilides are formed, but no 2:4-dichloroacetanilide. The speed of the change is about six times that of the system composed of acetylchloroaminobenzene and hydrochloric acid. On the assumption that the formation of the monochloroacetanilides is from the chlorine (set free from the acetylchloroamino-*p*-chlorobenzene) and acetanilide and not through the chloroamine of acetanilide, it should follow, since no 2 : 4-dichloroacetanilide is produced, that the rate of interaction of chlorine and acetanilide is very large relative to that of chlorine and *p*-chloroacetanilide. Comparative measurements made in glacial acetic acid, where only chlorine and anilide but no chloroamine are present (*loc. cit.*), show that the chlorination of acetanilide is about 160 times as speedy as that of *p*-chloroacetanilide.

From this view of the process of chlorination, it follows that the velocity is given by $k \,.\, c^{(\text{anilide})} \,.\, c^{(\text{chlorine})}$; but since the equilibrium $c^{(\text{chloroamine})} \,.\, c^{2\,(\text{hydrochloric acid})} = K \,.\, c^{(\text{anilide})} \,.\, c^{(\text{chloride})}$ holds (Orton and Jones, *loc. cit.*), the velocity equals $k \,.\, c^{(\text{chloroamine})} \,.\, c^{2\,(\text{hydrochloric acid})}/K$. Since the concentration of hydrochloric acid remains constant during the conversion of the chloroamine into a chloroanilide, the velocity of conversion in a system in which the proportion of chlorine and anilide is small (dilute acetic acid) is proportional to the original concentration (C) of the chloroamine, and $= k \,.\, C^{\text{(chloroamine)}}.\,\text{Const.}/K$; that is, the reaction is apparently unimolecular. When the proportion of chlorine and anilide is small, and at the same time the hydrochloric acid, the concentration of which is varied, is in excess, the speed of the transformation is approximately proportional to the square of the concentration of the hydrochloric acid used in the system. In Blanksma's observations on the transformation of acetylchloroaminobenzene, in which a considerable excess of hydrochloric acid was used, the reaction was found to be apparently unimolecular, and the speed proportional to the square of the concentration of the hydrochloric acid. When the above limitations are not imposed, the present measurements show that the reaction is not apparently unimolecular and the speed is not approximately proportional to the square of the concentration of the hydrochloric acid, but is in accord with the proposition laid down in the foregoing.

When chlorine and an anilide interact, two changes occur, namely, the formation of a *C*-chloro-derivative, an irreversible change, and the formation of an *N*-chloro-derivative, a reversible change. With the great majority of anilides, when the acetic acid medium is sufficiently dilute, the latter reaction is the more rapid; the equilibrium above mentioned is attained, which is only slowly displaced by the formation of the *C*-chloro-derivative. In the case of acetanilide, however, chlorination in the nucleus is faster than in the imino-group.

It is suggested that the peculiar influences of amino-, imino-, and hydroxy-groups on substitution in the benzene nucleus are largely due to the possibility which their presence offers of the transient formation of highly reactive *o*- and *p*-quinonoid phases of the benzene nucleus.

240. "The benzyl and nitrobenzyl selenosulphates and the benzyl and nitrobenzyl diselenides." By Thomas Slater Price and Lionel Manfred Jones.

In a preliminary note (Proc., 1908, **24**, 134) the preparation of benzyl diselenide from sodium selenosulphate and benzyl chloride has been described. An attempt to extend this method of preparation to the nitrobenzyl diselenides was not successful until the sodium selenosulphate was replaced by the potassium salt.

The diselenides were prepared from the alkyl selenosulphates either by the action of iodine or by electrolysis in a divided cell after potassium hydrogen carbonate had been added to the solution (compare Price and Twiss, *Trans.*, 1907, **91**, 2021). The iodine method was the most general one, the reaction taking place quantitatively at the ordinary temperature, according to the equation:

$$2KO\cdot SO_2SeR + 2H_2O + I_2 = R_2Se_2 + 2KHSO_4 + 2HI.$$

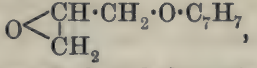
This reaction was made use of in the analysis of the selenosulphates. Benzyl and also the *p*- and *m*-nitrobenzyl diselenides could be prepared by the electrolytic method, but not the corresponding ortho-compound.

The potassium benzyl and nitrobenzyl selenosulphates are all crystalline compounds, which are fairly readily soluble in water; the solutions give no precipitate with barium chloride. The *p*-nitrobenzyl compound possesses a slight creamy tinge, the others being colourless.

The diselenides are all more or less yellow, crystalline compounds, their melting points being: benzyl, 92—93°; nitrobenzyl: ortho, 103·5°; meta, 106°; para, 107·5°.

Both the selenosulphates and the diselenides undergo decomposition with liberation of selenium on exposure to diffused daylight. The benzyl compounds are the least stable, turning red in a few hours. Exposure of one or more days is necessary to affect the nitrobenzyl compounds, the meta being the most stable.

241. "The action of ammonia on the glycide aryl ethers. Part I. *o*-Tolyloxypropanolamines." By David Runciman Boyd and [in part] Herbert S. Knowlton.

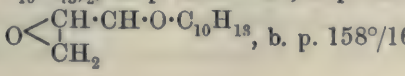
Glycide o-tolyl ether,  $O{<}\genfrac{}{}{0pt}{}{CH\cdot CH_2\cdot O\cdot C_7H_7}{CH_2}$, an oil boiling at 134·5°/14 mm., has been prepared, and the action of aqueous ammonia on it has been investigated.

Three bases have been isolated, namely, *β-amino-β′-o-tolyloxyisopropyl alcohol*, $C_{10}H_{13}O_2\cdot NH_2$, m. p. 58—60°, b. p. 177°/11 mm.; *dihydroxy-di-o-tolyloxydipropylamine*, $(C_{10}H_{13}O_2)_2NH$, m. p. 117·5°, and *trihydroxy-tri-o-tolyloxytripropylamine*, $(C_{10}H_{13}O_2)_3N$, m. p. 83—84°.

Various derivatives of these bases were described.

242. "The action of potassium hydroxide on epichlorohydrin in presence of monohydric phenols." By David Runciman Boyd and Ernest Robert Marle.

A criticism of Zunino's paper (*Atti R. Accad. Lincei*, 1909, [v], **18**, i, 254).

The following new compounds were described: *glycerol dithymyl ether*, $OH\cdot CH(CH_2\cdot O\cdot C_{10}H_{13})_2$, m. p. 41·5—42°, b. p. 270°/28 mm., and *glycide thymyl ether*,  $O{<}\genfrac{}{}{0pt}{}{CH\cdot CH\cdot O\cdot C_{10}H_{13}}{CH_2}$, b. p. 158°/16 mm.

243. "Reactivity of the halogens in organic compounds. Part III. Interaction of bromoacetic, α-bromopropionic, and α-bromobutyric acids and their sodium salts with water and with alkali." By George Senter.

The results of the velocity measurements are summarised in the accompanying table, in which *k* in each case represents the initial velocity, in *N*/10-solution at 52·4°, of the reaction represented by the equation below which it is placed. The numbers in brackets give the relative initial velocities of the reactions under equivalent conditions, referred to the slowest—the reaction between bromoacetic acid and water—as unity.

$CH_2Br\cdot CO_2H + H_2O$. $k = 0\cdot000085$ [1]	$CHMeBr\cdot CO_2H + H_2O$. $0\cdot00017$ [2]	$CHEtBr\cdot CO_2H + H_2O$. $0\cdot00022$ [2·6]
$CH_2Br\cdot CO_2Na + H_2O$. $k = 0\cdot00010$ [1·2]	$CHMeBr\cdot CO_2Na + H_2O$. $0\cdot0014$ [16]	$CHEtBr\cdot CO_2Na + H_2O$. $0\cdot0026$ [30]
$CH_2Br\cdot CO_2Na + NaOH$. $k = 0\cdot0065$ [76]	$CHMeBr\cdot CO_2Na + NaOH$. $0\cdot0009$ [9]	$CHEtBr\cdot CO_2Na + NaOH$. $0\cdot0007$ [8]
$CH_2Br\cdot CO_2H + AgNO_3$. $k = 0\cdot0064$ [76]	$CHMeBr\cdot CO_2H + AgNO_3$. $0\cdot48$ [5700]	$CHEtBr\cdot CO_2H + AgNO_3$. $1\cdot44$ [17000]

As regards the mechanism of the chemical changes, the main reaction for those of the first type probably takes place between non-ionised acid and non-ionised water. In the case of the sodium salts and water, the experimental results are best accounted for on the assumption that the anion loses a bromine atom along with the negative electron, thus: $R\cdot CHBr\cdot COO' \longrightarrow R\cdot CH\cdot COO + Br'$, the residue immediately uniting with water to form the hydroxy-acid. The main reaction with the sodium salts and sodium hydroxide takes place between the anions $R\cdot CHBr\cdot COO'$ (where R represents hydrogen or an alkyl group) and OH' ions. The comparatively slow reaction between these ions (as contrasted with the rapidity of ester hydrolysis) is probably due to repulsion between the negative charges on the two groups. The results with silver nitrate are provisional, and these reactions will be discussed in a later communication.

244. "Ethyl ether. Part I. The influence of water and alcohol on its boiling-point." By John Wade and Horace Finnemore.

Ether as usually purified is not homogeneous, and is resolvable into two physical constituents by accurate fractionation. The more volatile constituent contains water that has escaped the ordinary drying agents, and under suitable conditions may be isolated as a binary mixture of ether and water, having a constant and minimum boiling-point, 34·15° (corr.), and containing about 1·3 per cent. of water. At the ordinary temperature this binary mixture is practically a saturated solution of water in ether; it has been found incidentally that the solubility of water is approximately constant at 0·013 gram per gram of ether between 20° and 15°, and then decreases to 0·009 gram per gram at 10°, the lowest temperature examined.

The less volatile constituent obtained on fractionating ordinary ether is approximately pure ether, b. p. 34·50° (corr.). In presence of alcohol the boiling point may be appreciably raised, by an amount varying with the proportion of alcohol in the still; the highest observed was 34·73° (corr.). There is no evidence, however, of the formation of a definite physical mixture, for although a very appreciable amount of alcohol passes over with the ether, this may be gradually eliminated by repeated fractionation. Alcohol has a similar influence on the boiling point of the binary aqueous mixture, and when ether containing both water and alcohol is fractionated, indications of a third physical constituent are sometimes obtained. This, however, is not due to the formation of a binary mixture of ether and alcohol, nor to that of a ternary mixture of all three substances, but is probably caused by the elevation in the boiling point of the binary aqueous mixture as the concentration of the alcohol increases.

The mutually opposing influences of water and alcohol on the boiling point of ether render constancy of its boiling point as determined in the ordinary manner useless as a criterion of purity.

245. "A method for the measurement of vapour pressures."
By Alexander Charles Cumming.

A solution or hydrate is kept at constant temperature in an evacuated glass vessel, and the vapour tension measured by a dew-point method. In the apparatus described, a silver cylinder is cooled slowly and the temperature noted at which dew appears on the silver surface. The corresponding vapour pressure is then obtained by reference to a table of vapour pressures of the pure solvent. With attention to certain details, the method was found to be convenient and accurate. The vapour pressures of different concentrations of sulphuric acid at various temperatures were determined, and the results were found to be in good accord with the values given by Regnault and by Sorel. A few measurements of the vapour tensions of salt hydrates were also made. The method has the marked advantage over the differential tensimeter method that no error is introduced by small amounts of residual air in the apparatus.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Abderhalden, *Emil.* [Editor.] Handbuch der biochemischen Arbeitsmethoden. Vols. I. i., II. i. pp. iv + 512, 496. ill. Wien 1909. (*Recd.* 1/9/09.)
From the Publishers: Messrs. Urban & Schwarzenberg.

Accum, *Fredrick.* A practical treatise on the use and application of chemical tests. 3rd edition. pp. 527. ill. London 1820. (*Recd.* 10/7/09.) From Dr. J. McCrae.

Biltz, *Heinrich,* and **Biltz,** *Wilhelm.* Laboratory methods of inorganic chemistry. Authorised translation by *William T.* **Hall** and *Arthur A.* **Blanchard.** pp. xv + 258. ill. New York 1909. (*Recd.* 26/6/09.) From the Publishers: Messrs. John Wiley & Son.

Cavalier, *J.* Leçons sur les alliages métalliques. pp. xix + 466. ill. Paris 1909. (*Recd.* 1/9/09.) From the Author.

Caven, *Robert Martin.* Systematic qualitative analysis. pp. xii + 240. London 1909. (*Recd.* 12/10/09.) From the Author.

Clowes, *Frank,* and **Coleman,** *J. Bernard.* Quantitative chemical analysis. 8th edition. pp. xxiv + 565. ill. London 1909. (*Recd.* 25/9/09.) From the Publishers: Messrs. J. & A. Churchill.

Gadd, *H. Wippell.* The poisons and pharmacy act, 1908. With notes. pp. 55. London 1909. (*Recd.* 24/7/09.) From the Author.

Horn, *Georg.* Arca Mosis, sive Historia Mundi. pp. [xxxiv] + 200 + [xx]. Lugd. Bat. & Roterod. 1668. (*Recd.* 10/7/09.)
From Dr. J. McCrae.

Jago, *William.* A manual of forensic chemistry dealing especially with chemical evidence, its preparation and adduction. Based upon a course of lectures delivered at University College, University of London. pp. viii + 256. London 1909. (*Recd.* 8/10/09.)
From the Author.

Lewkowitsch, *Julius.* Chemical technology and analysis of oils, fats, and waxes. 4th edition. 3 vols. pp. xx + 542, xii + 816, viii + 407. ill. London 1909. (*Recd.* 24/6/09.) From the Author.

Osborne, *Thomas B.* The vegetable proteins. pp. xiii + 125. London 1909. (*Recd.* 16/10/09.)
From the Publishers: Messrs. Longmans, Green & Co.

Ville, *Georges.* Artificial manures: their chemical selection and scientific application to agriculture. New edition, revised by *Sir William* **Crookes** and *John* **Percival.** pp. xxxviii + 347. ill. London 1909. (*Recd.* 21/7/09.) From Sir William Crookes.

II. *By Purchase.*

Eibner, *A.* Malmaterialienkunde als Grundlage der Maltechnik. pp. xxiii + 480. Berlin 1909. (*Recd.* 16/6/09.)

Lunge, *Georg.* Handbuch der Soda-Industrie und ihrer Nebenzweige. Vol. II. 3rd edition. (Bolley's *Handbuch* Neue Folge, 16.) pp. xviii + 868. ill. Braunschweig 1909. (*Recd.* 26/6/09.)

Spiegel, *Leopold.* Chemische Konstitution und physiologische Wirkung. (Sammlung, Vol. xiv.) Stuttgart 1909.

Teichert, *Kurt.* Methoden zur Untersuchung von Milch und Molkereiprodukten. (Die chemische Analyse, Vol. viii & ix.) Stuttgart 1909.

III. *Pamphlets.*

Auerbach, *Friedrich*, and **Plüddemann**, *Werner.* Massanalytische Bestimmung von Ameisensäure und ihren Salzen. (From the *Arbeiten K. Gesundheitsamte*, 1909, **30**.)

Barschall, *Hermann.* Über Krabbenextrakt. (From the *Arbeiten K. Gesundheitsamte*, 1909, **30**.)

Baur, *Emil.* Über die Bestimmung des Zuckers im Fleisch. (From the *Arbeiten K. Gesundheitsamte*, 1909, **30**.)

Bongiovanni, *Corrado.* Sulla ricerca microchimica del fosforo nei vegetali. (From the *Atti R. Istituto Veneto*, 1907–08, **67**.)

—— Nuovi modi di colorazione delle formazioni fosforate vegetali. (From *Le Staz. sper. agrar. ital.*, 1909, **42**.)

Bradley, *W. P.*, **Browne**, *A. W.*, and **Hale**, *C. F.* Effect of mechanical vibration upon carbon dioxide near the critical temperature. II. (From the *Physical Review*, 1908, **26**.)

—— Liquid above the critical temperature. (From the *Physical Review*, 1908, **27**.)

Breinl, **A.**, and **Nierenstein**, *M.* Zum Mechanismus der Atoxylwirkung. (From the *Zeitsch. Immunitätsforsch. exp. Therap.*, 1909.)

Brode, *Johannes*, and **Lange**, *Wilhelm.* Beitrage zur Chemie des Essigs mit besonderer Berücksichtigung seiner Untersuchungsverfahren. (From the *Arbeiten K. Gesundheitsamte*, 1909, **30**.)

Collins, *S. H.* On the difference between duplicates as a measure of error. (From the *Proc. Univ. Durham Phil. Soc.*, 1908–9, **3**.)

Curtius, *Theodor.* Die Enthüllung des Bunsen-Denkmales. pp. 40. ill. Heidelberg, 1908.

Dezani, *Serafino.* Lecitine e colesterine contenute nello sperma e nelle ovaie del tonno. (From the *Giorn. R. Accad. Med. Torino*, 1909, **15**.)

Douris, *Roger.* Sur la tiodine. (From the *Bull. Sci. pharm.*, 1908.)

Evans, Sons, Lescher, and Webb, Ltd. Analytical notes. 1908. pp. 48.

Fischel, *Alfred.* Über Beeinflussung der vitalen Nervenfärbung durch chemische Agentien. (From the *Zentr. Physiol.*, 1908, **22.**)

Fischer, *H. Waldemar,* and **Bobertag,** *O.* Zur Theorie der reversibelen Sole. (From the *Jahrsb. Schles. Ges. vaterländ. Cult. Naturwiss. Sek.*, 1908.)

Fulda, *W.* Die Absorption des Schwefeldioxyds in Wasser. (From the *Arbeiten K. Gesundheitsamte*, 1909, **30.**)

Gallo, *Nicolò.* Dei correttivi dell' acidità e di un nuovo metodo per la determinazione dell' acidità volatile libera nei vini. (From *Le Staz. sper. agrar. ital.*, 1909, **42.**)

Haanel, *Eugene.* Report on the investigation of an electric shaft furnace, Domnarfvet, Sweden, &c. (Canadian Department of Mines.) pp. 38. ill. Ottawa, 1909.

Haensel, *Heinrich.* Bericht, April–September, 1908, Oktober–März, 1908–09. pp. 83, 82.

Indian Association for the Cultivation of Science. Report for the year 1907. pp. 65. Calcutta 1909.

Laqueur, *E.* Über die Wirkung von Gasen auf die Autolyse mit Rücksicht auf ihre Beeinflussung des Stoffwechsels. (From the *Schriften. Physik.-ökonom. Ges. Königsberg i. Pr.*, 1909, **50.**)

—— Über die Wirkung des Arsens auf die Autolyse. (From the *Schriften. Physik.-ökonom. Ges. Königsberg i. Pr.*, 1909, **48.**)

Loeb, *Leo,* **Fleisher,** *S. M.*, and **Hoyt,** *D. M.* Über den Einfluss von Calciumchlorid auf die Bildung von Transsudaten. (From the *Zentr. Physiol.*, 1908, **22.**)

Mameli, *E.*, and **Patta,** *A.* Sull' acido para-iodiofenilarsinico e sull' ioduro di para-iodiofenilarsenico. (From the *Boll. Soc. Med.-Chirurg. Pavia*, 1909.)

Martindale, *W. Harrison.* Organic arsenic compounds. A communication to the International Congress of Applied Chemistry, 1909. Pharmaceutical chemistry section. pp. 11. London 1909.

Metropolitan Water Board. Fourth report on research work. By *A. C.* **Houston.** pp. 18. London 1909.

—— Report on the results of the chemical and bacteriological examination of the London waters for the twelve months ended 31 March, 1909. By *A. C.* **Houston.** pp. 42. London 1909.

Nelson, *J. M.*, and **Falk,** *K. George.* The electron conception of valency in organic chemistry. (From the *School of Mines Quarterly*, 1909, **30.**)

New Zealand, *Department of Agriculture. Chemistry division.* Report, 1908. pp. 322. ill. Wellington 1908.

Noll, *A.* Über Fettsynthese im Darmepithel des Frosches bei der

Fettresorption. (From the *Archiv. Anat. Physiol., Physiol. Abtlg. Suppl.*, 1908.)

Perotti, *Renato.* Su la nutrizione azotata della pianta a mezzo dello sostanze amidate. (From *Le Staz. sper. agrar. ital.*, 1908, **41**.)

Quartaroli, *A.* Contributo allo studio dei fosfati, delle loro isomerie e delle trasformazioni che essi subiscono nel terreno. (From the *Staz. sper. agrar. ital.*, 1909, **42**.)

Richardson, *Clifford.* Bituminous materials for use in and on road surfaces, and means of determining their character. pp. 11. New York 1909.

—— Asphalt macadam roadways. pp. 6. ill. New York 1909.

Richardson, *Clifford,* and **Forrest,** *C. N.* Methods for the examination of bituminous materials for road construction as practised in the New York Testing Laboratory. pp. 8. New York 1909.

Rohland, *P.* Über das Verhalten von suspendierten Stoffen im Kristalloid und Kolloidzustand. (From the *Physik.-chem. Centr.*, 1908, **6**.)

Schall, *C.* Zur Demonstration der Absorption farbloser Lösungen im Ultraviolett. (From the *Zeitsch. physikal. chem. Unter.*, 1908.)

—— Über Zersetzung von Tetrachlorkohlenstoffdampf im elektrischen Hochspannungs-Lichtbogen. (From the *Zeitsch. physikal. chem. Unter.*, 1908.)

Schimmel & Co. Semi-annual report, November, 1908.

—— Bericht, April, 1909. pp. 233, 133.

Transvaal *Government Laboratories.* Annual report for the year 1907–08. pp. 30. Pretoria 1909.

West Indies, *Imperial Department of Agriculture.* Sugar-cane experiments in the Leeward Islands. Two parts. pp. iv + 76, iv + 22. Barbados 1909.

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in December next. Applications for Grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, 6th December, 1909.

All persons who received grants in December, 1908, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Wednesday, 1st December.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal tar and allied industries.

At the next Ordinary Scientific Meeting on **Thursday**, November **4th**, 1909, at **8.30** p.m., the following papers will be communicated:

"Dynamics of the reaction between iodine and acetone." By H. M. Dawson and Miss M. S. Leslie.

"The formation and reactions of imino-compounds. Part XI. The formation of 1-imino-2-cyano*cyclo*pentane from adiponitrile." By J. F. Thorpe.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 12/11/09.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 25. No. 361.

Thursday, November 4th, 1909, at 8.30 p.m., Professor HAROLD B. DIXON, F.R.S., President, in the Chair.

Messrs. R. Müller and H. S. Wills were formally admitted Fellows of the Society.

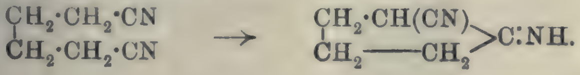
Certificates were read for the first time in favour of Messrs. :

Arthur Fordshaw, M.Sc., 104, Holly Road, Handsworth, Birmingham.
Alexander David Gardiner, 6, Wellfield Terrace, Springburn, Glasgow.
Eric John Holmyard, 7, Manor Street, Cambridge.
Francis Hugh Ping, 10, Forest Place, Whipps Cross Road, Leytonstone, N.E.
Richard Vernon Wheeler, D.Sc., British Coal Dust Experiments Committee, Altofts Colliery, Normanton.

Of the following papers, those marked * were read :

*246. "The formation and reactions of imino-compounds. Part XI. The formation of 1-imino-2-cyano*cyclo*pentane from adiponitrile." By Jocelyn Field Thorpe.

A method was described by which *aδ*-dicyanobutane (adiponitrile) can be completely converted into 1-imino-2-cyano*cyclo*pentane in accordance with the scheme :



$$\begin{array}{l} CH_2\cdot CH_2\cdot CN \\ CH_2\cdot CH_2\cdot CN \end{array} \longrightarrow \begin{array}{l} CH_2\cdot CH(CN) \\ CH_2 \text{——} CH_2 \end{array} > C{:}NH.$$

DISCUSSION.

The PRESIDENT asked whether, if the second cyano-group was necessary for the reaction to proceed (though it remains at the end unchanged), it did not point to a transitory interaction between this group and the catalyst?

Dr. J. F. THORPE, in reply, said that the precise mechanism of the reaction was still open to question, but the nitrile group remaining unaffected apparently had some influence, since its presence seemed to be essential.

In reply to Dr. MORGAN, he stated that the use of piperidine, diethylamine, and other catalytic agents of that type did not lead to the formation of imino-compounds.

In reply to Mr. BALY, Dr. Thorpe said that so far as he knew there was no chemical evidence of a hydrogen atom of the methylene group of ethyl cyanoacetate wandering to the nitrogen atom under the influence of sodium ethoxide.

*247. "Studies in the camphane series. Part XXVII. Camphorylphenyltriazen (camphordiazoaminobenzene) and its bearing on the constitution of diazoamino-compounds." By Martin Onslow Forster and Charles Samuel Garland.

From a study of the compounds derived from aminocamphor and from methylaminocamphor by coupling these bases with diazonium salts, the authors conclude that aliphatic-aromatic diazoamino-compounds must be represented by the expression $X{\cdot}N{:}N{\cdot}NH{\cdot}C_6H_5$, the hydrogen atom of the triazen nucleus taking up a position of superior stability in the neighbourhood of the phenyl group rather than that of the alkyl radicle, X.

DISCUSSION.

Dr. MORGAN said that the authors' experiments amply justified the conclusions which they deduced in regard to the constitution of mixed aliphatic-aromatic diazoamines.

With reference to mixed diazoamines containing two aryl (benzenoid) groups X and Y, he could not, in the present state of knowledge, share Dr. Forster's belief that the coupled product of diazonium salt, $X{\cdot}N_2Cl$, and aromatic amine, $Y{\cdot}NH_2$, is entirely either $X{\cdot}N_2{\cdot}NH{\cdot}Y$ or

$$X{\cdot}NH{\cdot}N_2{\cdot}Y.$$

He preferred to regard the product, formed under the ordinary experimental conditions, as a mixture of these two isomeric diazoamines.

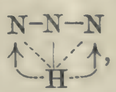
The observations of Griess, Meldola, Schraube, Hantzsch, and others showed conclusively that, when a diazonium salt and an aromatic amine are dissolved together in dilute acid, a certain amount of rearrangement occurs consequent on the migration of diazo-nitrogen. The solution, if only feebly acid, then contains the following four reagents, *a*, *b*, *c*, and *d* (two diazo-hydroxides and two primary aromatic amines), produced by hydrolysis from their respective salts.

$$\begin{array}{ccc} X\cdot N_2\cdot OH & & Y\cdot NH_2 \\ a & \longleftrightarrow & b \\ X\cdot NH_2 & & Y\cdot N_2\cdot OH \\ c & \longleftrightarrow & d \end{array} \longrightarrow \left\{\begin{array}{l} X\cdot N_2\cdot NH\cdot Y \\ X\cdot NH\cdot N_2\cdot Y \end{array}\right\}.$$

In the formation of the mixed diazoamine, coupling occurs along the lines *ab* and *cd*, with the result that the precipitated product is a mixture in which the proportions of $X\cdot N_2\cdot NH\cdot Y$ and $X\cdot NH\cdot N_2\cdot Y$ depend on the extent to which the migration of diazo-nitrogen has occurred.

The same result is obtained whether one starts with $X\cdot N_2Cl$ and $Y\cdot NH_2$ or with $Y\cdot N_2Cl$ and $X\cdot NH_2$. Migration of diazo-nitrogen occurs in either case; the same four reagents, *a*, *b*, *c*, and *d*, become effective, and their interaction determines the nature of the coupled product.

Dr. J. F. THORPE pointed out that if the system of three nitrogen atoms with a double valency between two of them described by Dr. Forster could be considered as analogous to the system of two carbon atoms and one oxygen atom ($C\cdot C{:}O$), as in ethyl acetoacetate, or to the system of three carbon atoms with a double valency between two of them ($C\cdot C{:}C$), as in glutaconic acid, then any hydrogen attached to the extreme nitrogen atoms might be regarded for experimental purposes as being attached to the central nitrogen atom, thus:



in the same manner as in glutaconic acid.

In no case of this kind would there be reasonable hope of obtaining any trustworthy chemical evidence respecting the position of the hydrogen atom.

Dr. FORSTER was prepared to admit that aromatic diazoamino-compounds, when produced in the coupling process, exposed to light, and recrystallised from hot solvents, behaved as Dr. Morgan indicated, namely, as a mixture of two isomeric diazoamines, but he attributed this to an alteration of $X\cdot N_2\cdot NH\cdot Y$ into $X\cdot NH\cdot N_2\cdot Y$, effected by the environment, such alteration proceeding with greater facility when the attraction exerted by Y for the hydrogen in the triazen chain did not differ greatly from that exerted by X. He was led to this conclusion principally by three circumstances.

1. The numerous cases of resolution by acids upon which current views regarding the constitution of aromatic diazoamino-compounds are based have been studied most frequently at temperatures ranging from that of the laboratory to 100°, instead of at zero or below.

2. When prepared by Dimroth's method, from arylazoimide and magnesium aryl halide, α-naphthylphenyltriazen is resolved by

alcoholic hydrogen chloride below zero into α-naphthyldiazonium chloride and aniline, unaccompanied by α-naphthylamine.

3. There does not appear to have been recorded a case in which two isomeric diazo-carbamides have arisen by direct action of phenylcarbimide on a diaryltriazen.

248. "Dynamics of the reaction between iodine and acetone." By Harry Medforth Dawson and May Sybil Leslie.

The physical properties of solutions of iodine in acetone are abnormal, and it has been found that this is due to a reaction resulting in the formation of hydrogen iodide and one or more iodoacetones. At the ordinary temperature the reaction takes place fairly rapidly, but is incomplete, indicating that the change is reversible.

In order to elucidate its mechanism, the authors have made measurements of the velocity of the reaction, the rate of change being diminished by dissolving the reacting substances in various inert solvents. In aqueous solution, the reaction proceeds much more nearly towards completion than it does in carbon tetrachloride, benzene, nitrobenzene, methyl alcohol, or methyl acetate. On the other hand, the velocity of the change in neutral solution appears to be much slower in water than it is in the other solvents used.

A detailed examination of the reaction in aqueous solution has shown that in presence of acids the rate of disappearance of the iodine is constant when the acetone is present in relatively large excess. In solutions acidified with sulphuric acid, the velocity is proportional to the concentration of the acid and also to that of the acetone. If no foreign acid is added, an autocatalytic effect is observed, due to the hydrogen iodide formed during the reaction.

249. "Studies in phototropy and thermotropy. Part I. Arylidene- and naphthylidene-amines." By Alfred Senier and Frederick George Shepheard.

In a recent paper, the authors described a series of Schiff's bases (salicylidene-amines), one of which, namely, salicylidene-*m*-toluidine, was found to be highly phototropic (*Trans.*, 1909, **95**, 441). The investigation has now been extended to the study of a number of other salicylidene-amines and related compounds, and five compounds, including salicylidene-*m*-toluidine, which exhibit phototropy have been prepared.

Early in this investigation it was observed that many of the coloured bases became deeper in colour on heating, and that this change, like phototropy, was reversible. The whole of the compounds in question were then subjected to an examination to obtain further evidence, if possible, of this property. Their colour changes were noted (1) between the ordinary temperature and a temperature just below their melting points, and (2) between the ordinary temperature and that of solid carbon dioxide. This led to the interesting fact that most of the compounds exhibit this phenomenon, which has long been known, in isolated instances, among inorganic substances. This reversible change of colour the authors propose to term *thermotropy*.

Whilst it is possible that phototropic and thermotropic isomerism may be explained by intramolecular rearrangement, as is generally supposed, it seems more probable, bearing in mind that the substances affected are solids, that it depends on different modes of aggregation of the ordinary molecules which may be supposed to be grouped together in the probably much more complex molecules of solids.

250. "The action of mercaptans on acid chlorides. Part I. Oxalyl chloride; the mono- and di-thio-oxalates." By Humphrey Owen Jones and Hubert Sanderson Tasker.

The following esters of dithio-oxalic acid have been prepared by the action of oxalyl chloride on the corresponding mercaptans or their metallic derivatives. *Phenyl dithio-oxalate*, a sulphur-yellow solid, melting at 119—120°, and distilling undecomposed. *Methyl dithio-oxalate*, pale yellow prisms, melting at 82·5—83·5°. *Ethyl dithio-oxalate*, yellow prisms, melting at 27—27·5°, and distilling at 235°. *Propyl dithio-oxalate* and *amyl dithio-oxalate*, yellow liquids, the former distilling at 158°/15 mm., and the latter at 206°/19 mm.

On boiling these esters with an alcoholic solution of potassium hydrosulphide, the mercaptan is set free, and *potassium dithio-oxalate*, $(KSCO)_2$, separates as a white, crystalline powder. This salt can be used as a delicate test for nickel or cobalt, owing to the formation of a complex potassium nickelo- or cobalto-thio-oxalate, which is intensely coloured. The nickel salt is less stable towards potassium cyanide and strong acids than the cobalt salt, so that by adding potassium cyanide the colour of the nickel salt can be destroyed before that of the cobalt salt, and in this way 10 per cent. of cobalt can be detected in the presence of 90 per cent. of nickel. The colour of the nickel and cobalt salts can be seen readily at dilutions of 1 in 40,000,000 on looking through 25 cm. of solution.

251. "The action of mercaptans on acid chlorides. Part II. The acid chlorides of phosphorus, sulphur, and nitrogen." By Hubert Sanderson Tasker and Humphrey Owen Jones.

Phosphorus trichloride reacts with phenyl mercaptan or its metallic derivatives to give triphenyl trithiophosphite as stated by Schwarze;

phosphoryl chloride similarly gives triphenyl trithiophosphate, melting at 115° (Schwarze gave the melting point as 72°, and this was corrected by Michaelis).

Sulphuryl chloride in the cold gives a deep yellow colour, probably due to the formation of an ester, which disappears with the formation of phenyl disulphide and the evolution of sulphur dioxide.

Thionyl chloride also gives a yellow colour in the cold, but this again disappears quickly; phenyl disulphide is formed and sulphur dioxide is evolved, but the possible new oxide of sulphur, SO, is not formed.

Numerous experiments were made to discriminate between the two following equations to represent this reaction:

$$8C_6H_5{\cdot}SH + 4SOCl_2 = 8HCl + 2SO_2 + 3(C_6H_5{\cdot}S)_2 + (C_6H_5)_2S_4$$
$$4C_6H_5{\cdot}SH + SOCl_2 = (C_6H_5{\cdot}S)_2 + (C_6H_5)_2S_3 + H_2O + 2HCl.$$

It was found that both reactions seem to take place simultaneously, but that the main reaction appears to be represented by the first equation.

Nitrosyl chloride reacts readily with mercaptans in the cold; hydrogen chloride is evolved, and brilliant red colours are produced (probably due to the formation of esters of thionitrous acid), which gradually disappear with the evolution of nitric oxide and the formation of alkyl disulphide. The same colour is produced by the action of the chloride on the mercaptides. When nitrosyl chloride is treated with an alkyl mercaptan at a low temperature (solid carbon dioxide and ether), a small quantity of hydroxylamine hydrochloride is always formed.

252. "The colouring matters of the flowers of Hibiscus sabdariffa and Thespasia lampas." By Arthur George Perkin.

The flowers of the *Hibiscus sabdariffa* yielded 0·36 per cent. of a mixture of three yellow colouring matters, the main constituent of which, $C_{15}H_{10}O_8$, crystallising in yellow needles, gives an *acetyl* derivative, $C_{15}H_4O_8(C_2H_3O)_6$, m. p. 229—230°, and, on fusion with alkali, protocatechuic acid. It was identical with gossypetin present in Indian cotton flowers (*Gossypium herbaceum*), the formula, $C_{16}H_{12}O_8$, previously given for which is now abandoned. Together with quercetin, the flowers yielded a trace of a sparingly soluble new colouring matter, for which the name *hibiscetin* is proposed; this melts at about 340°, and gave a colourless *acetyl* compound, m. p. 238—239°. In addition to these substances, free protocatechuic acid was also isolated. The flowers of *Thespasia lampas* gave quercetin to the extent of 0·6 per cent., together with a small quantity of free protocatechuic acid.

253. "The reduction of 4-hydroxy-*o*-toluic acid." By Oscar Baudisch, Gilbert Stanley Hibbert, and William Henry Perkin, jun.

By reducing 4-hydroxy-*o*-toluic acid with sodium and alcohol, the authors have obtained the four possible isomerides, namely, the two cis- and the two trans-1-*methyl*cyclo*hexan*-4-*ol*-2-*carboxylic acids*, of which various derivatives were described. 1-*Methyl*-Δ^6-cyclo*hexen*-4-*ol*-2-*carboxylic acid* is also formed in this reaction.

254. "The reduction of 6-hydroxy-*o*-toluic acid."

By Oscar Baudisch and William Henry Perkin, jun.

On reduction with sodium and alcohol, 6-hydroxy-*o*-toluic acid yields a mixture of cis- and trans-1-*methyl*cyclo*hexan*-6-*ol*-2-*carboxylic acid*.

255. "The reduction 5-hydroxy-*m*-toluic acid."

By Andrew Norman Meldrum and William Henry Perkin, jun.

By reducing 5-hydroxy-*m*-toluic acid with sodium and *iso*amyl alcohol, the authors have prepared trans-1-*methyl*cyclo*hexan*-5-*ol*-3-*carboxylic acid*. This is converted into the corresponding cis-*acid* by distillation and hydrolysing the resulting lactone.

256. "The reaction between potassium permanganate and manganese sulphate in acid solution." By Anukul Chandra Sirkar and Jatindra Mohon Dutta.

The authors find that in neutral or very faintly acid solution at 85° the reaction between potassium permanganate and manganese sulphate is in accordance with the equation:

$$3MnSO_4 + 2KMnO_4 + 2H_2O = 5MnO_2 + K_2SO_4 + 2H_2SO_4.$$

In solution freely acidified with sulphuric acid at 85° the reaction is practically the same as in neutral or faintly acid solution; at 100° the manganese dioxide which has been formed by the interaction between the permanganate and manganese salt is attacked by the acid of the solution, forming a certain quantity of manganese sulphate in accordance with the equation:

$$2MnO_2 + 2H_2SO_4 = 2MnSO_4 + 2H_2O + O_2.$$

The manganese sulphate thus formed reacts with a further quantity of potassium permanganate,

$$3MnSO_4 + 2KMnO_4 + 2H_2O = 5MnO_2 + K_2SO_4 + 2H_2SO_4,$$

and these two reactions occur in a cycle indefinitely, or so long as the solution remains freely acid.

In solutions which were at the start neutral, a certain amount of sulphuric acid is at first produced, but this subsequently becomes used up, and thus in this case a limit is put to the amount of permanganate reduced by a limited quantity of manganese salt even at 100°.

This investigation offers an explanation of what might be termed the catalytic reduction of potassium permanganate in freely acid solution by either manganese salt or manganese dioxide.

257. "The condensation of ketones and aldehydes with the sodium derivative of ethyl cyanoacetate. Part II." By **Henry Dent Gardner, jun.**, and **Walter Norman Haworth.**

An account was given of the investigation of the products formed by the condensation of ethyl sodiocyanoacetate with acetone, methyl ethyl ketone, methyl propyl ketone, diethyl ketone, and methyl hexyl ketone.

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in December next. Applications for Grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, 6th December, 1909.

All persons who received grants in December, 1908, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Wednesday, 1st December.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal tar and allied industries.

ERRATA.

1909. P. 187, line 8, *for* "formally elected" *read* "formally admitted."

P. 213, line 13, *for* "$16\overline{H}+2$" *read* "$16\overline{H}+2\mu$."

At the next Ordinary Scientific Meeting on **Thursday**, November **18th**, 1909, at **8.30** p.m., the following papers will be communicated:

"The resolution of asymmetrical derivatives of phosphoric acid." By B. D. W. Luff and F. S. Kipping.

"The configuration of tropeine and γ-tropeine and the resolution of atropine." By M. Barrowcliff and F. Tutin.

"The electromotive behaviour of cuprous oxide and cupric hydroxide in alkaline electrolytes." By A. J. Allmand.

"Note on the stereoisomeric modifications of αβ-dibromobenzylacetone." By Miss I. Smedley.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

[*Issued* 29/11/09

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 25. **No. 362.**

Thursday, November 18th, 1909, at 8.30 p.m., Professor HAROLD B. DIXON, F.R.S., President, in the Chair.

It was announced from the Chair that, on the motion of the PRESIDENT, seconded by Dr. Hugo Müller, the Council of the Society had, that afternoon, unanimously passed the following resolution:— The Council of the Chemical Society have heard with deep regret of the death of Dr. W. J. Russell, F.R.S., Past President of the Society. The Council recall the long services of Dr. Russell to the Society extending over nearly half a century. Elected a Fellow of this Society in 1851, Dr. Russell was first chosen a member of the Council in 1863, and with one short interval he served the Society continuously until his death. He was Vice-President in 1872, Secretary from 1873 to 1875, Treasurer from 1875 to 1889, and President from 1889 to 1891. Dr. Russell's communications to the Society began in the year 1855. Chemists throughout the world recognise the scientific importance of his memoirs on the atomic weights of Nickel and Cobalt, on the Absorption Spectra of solutions, and on the action of metals and of wood on photographic plates; and all workers on gas analysis are indebted to Dr. Russell for the new methods and apparatus he designed for the manipulation and measurement of gases. On behalf of the Chemical Society the Council desire to express their sense of the great loss that the Society and British Science have sustained, and beg to convey to the relatives of Dr. Russell their sincerest sympathy.

Signed, on behalf of the Society,
HAROLD B. DIXON,
President.

It was stated from the Chair that the Society had become indebted to Professor Meldola, F.R.S., for an interesting photograph of the Paris Exhibition Jury, 1900.

Certificates were read for the first time in favour of Messrs. :

Arthur Jaques, B.Sc., 23, St. Oswin's Avenue, Cullercoats, Northumberland.
Samuel Judd Lewis, B.Sc., Ph.D., 122, Newington Causeway, S.E.
Herbert William Southgate, B.Sc., 130, Horseferry Road, Westminster, S.W.
Stuart Jardine Norris Wolfenden, The Grange, Sidcup, Kent.

Certificates have been authorised by the Council for presentation to ballot under Bye-Law I (3) in favour of Messrs. :

Edmund Victor Flack, Mayville, Wigtown Road, Green Point, S. Africa.
John Muller, B.A., Government Analytical Laboratory, Grahamstown, Cape Colony.
Joas Cornelio Rodrigues Peixoto, 52, Rua N.S. Copacabana, Rio de Janeiro (Brazil).
Charles Tapp, Cradock, Cape of Good Hope.
Joseph Pretty Wright, 883, Burrard Street, Vancouver, B.C.

The Council has ordered the following letter and report to be printed in the Journal and Proceedings of the Society :

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY,
SOUTH KENSINGTON,
LONDON, S.W.
November 17*th*, 1909.

GENTLEMEN,

I beg to present to the Council of the Chemical Society the Report of the International Committee on Atomic Weights, 1910, to which I have affixed, as desired by them, the signatures of Professors Ostwald and Urbain.

Since the Committee last reported, new determinations have been made of the atomic weights of chlorine, nitrogen, carbon, iodine, silver, phosphorus, arsenic, chromium, tellurium, mercury, palladium, krypton, and xenon.

Certain of the numbers obtained, if confirmed, would necessitate minor alterations in the tables, but as additional determinations are promised we prefer to make no very great changes until corroborative evidence is forthcoming. We suggest, however, that the value of Cr should be 52·0; that of As should be changed to 74·96; and we adopt the new values for krypton and xenon.

I am, Gentlemen,
Your obedient Servant,
T. E. THORPE.

The Hon. Secretaries,
The Chemical Society,
Burlington House,
London, W.

Report of the International Committee of Atomic Weights, 1910.

Since the preparation of our last report there has been much activity in the determination of atomic weights. A brief summary of the results obtained is as follows:

Chlorine.—A novel comparison of chlorine with oxygen is due to Guye and Fluss (*J. Chim. Phys.*, 1908, **6**, 732). Nitrosyl chloride, NOCl, was first weighed, and then distilled over silver to absorb chlorine, then over heated copper to absorb oxygen, and finally over metallic calcium, which retained the nitrogen. The complete analysis of the chloride was thus effected. From the direct weights of the oxygen and chlorine, $Cl = 35·468$.

Nitrogen.—In the investigation just cited, Guye and Fluss give data which correspond to $N = 14·006$. Guye and Pintza (*Compt. rend.*, 1908, **147**, 925) determined the density of the mixed gases produced by the decomposition of ammonia, and so measured its composition by volume. If $H = 1·0076$, then $N = 14·014$. The authors regard the determination as having only a significance corroborative of the lower value for nitrogen.

The ratio $AgCl : NH_4Cl :: 100 : 37·3217$ has been measured by Richards, Koethner, and Tiede (*J. Amer. Chem. Soc.*, 1909, **31**, 6). Reduced with $Ag = 107·881$, $Cl = 35·4574$, and $H = 1·0076$, $N = 14·0085$. If $H = 1·0078$, $N = 14·008$. The values assigned to silver and chlorine are derived from former researches by Richards and his colleagues in the Harvard laboratory.

Carbon.—From the ratio between silver and tetraethylammonium bromide, as measured by Scott (*Trans.*, 1909, **95**, 1200), $C = 12·017$ when $Ag = 107·88$. A single experiment with the corresponding methyl compound gave $C = 12·019$. These values are too high to be accepted until they have been confirmed by other methods.

From the density of methane, Baume and Perrot (*Compt. rend.*, 1909, **148**, 39) find $C = 12·004$. From the density of toluene, as determined by Ramsay and Steele, Leduc (*Compt. rend.*, 1909, **148**, 832) computes C = 12·003.

Iodine and Silver.—Baxter and Tilley (*J. Amer. Chem. Soc.*, 1909, **31**, 201) have determined the ratio between iodine pentoxide and silver. The pentoxide was reduced by means of hydrazine, and the hydriodic acid so produced was balanced in the usual way against silver. From the ratio thus found, $I_2O_5 : : 2Ag : : 100 : 64{\cdot}6225$ and 64·6230 (two series), combined with the ratio I : Ag : : 100 : 84·8843, the authors find that the atomic weight of Ag lies between 107·847 and 107·850. The corresponding value for iodine is I = 126·891.

Phosphorus.—From the density of phosphine, PH_3, Ter Gazarian (*Compt. rend.*, 1909, **148**, 1397) finds P = 30·906.

Arsenic.—Atomic weight redetermined by Baxter and Coffin (*J. Amer. Chem. Soc.*, 1909, **31**, 297). The ratios $Ag_3AsO_4 : 3AgCl$ and $Ag_3AsO_4 : 3AgBr$ were determined by two methods, one by solution and precipitation in the usual way, the other by heating the arsenate in a stream of hydrochloric or hydrobromic acid. The final mean result is As = 74·957 when Ag = 107·880.

Chromium.—From analyses of silver chromate by two methods, Baxter, Mueller, and Hines (*J. Amer. Chem. Soc.*, 1909, **31**, 529) find Cr = 52·008 when Ag = 107·88. With similar analyses of silver dichromate, Baxter and Jesse (*J. Amer. Chem. Soc.*, 1909, **31**, 541) find Cr = 52·013. The mean value is 52·01.

Tellurium.—Lenher (*J. Amer. Chem. Soc.*, 1909, **31**, 20) converted the double bromide K_2TeBr_6 into 2KCl by heating, first in a stream of chlorine, and afterwards in hydrochloric acid. Sixteen very concordant experiments were made, giving the molecular ratio between the two compounds. The final mean value is Te = 127·55.

Mercury.—Analyses of mercuric chloride have been made by Easley,* who determined the proportion of mercury in the compound, and also the ratio $HgCl_2 : 2AgCl$. By the first method, Hg = 200·48; by the second method, Hg = 200·62. These values are surprisingly high; but as Easley is to continue his investigation, it would be unwise to accept them until his work is all done. It is quite possible that the increase may be ultimately verified.

Palladium.—Atomic weight determined by Gutbier, Haas, and Gebhardt † by analyses of palladosammine bromide. The final most probable mean value when $N_2H_6Br_2 = 193{\cdot}908$ is Pd = 106·689.

Krypton and Xenon.—Moore (*Trans.*, 1908, **93**, 2181) isolated krypton and xenon in considerable quantities from the residues from

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* *Private communication.* Easley's work is soon to be published.

† *J. pr. Chem.*, 1909, [ii], **79**, 457. This includes the work of Haas, cited in the Report for 1909.

1910.

International Atomic Weights.

		O = 16.			O = 16.
Aluminium	Al	27·1	Molybdenum	Mo	96·0
Antimony	Sb	120·2	Neodymium	Nd	144·3
Argon	A	39·9	Neon	Ne	20·0
Arsenic	As	74·96	Nickel	Ni	58·68
Barium	Ba	137·37	Nitrogen	N	14·01
Bismuth	Bi	208·0	Osmium	Os	190·9
Boron	B	11·0	Oxygen	O	16·00
Bromine	Br	79·92	Palladium	Pd	106·7
Cadmium	Cd	112·40	Phosphorus	P	31·0
Cæsium	Cs	132·81	Platinum	Pt	195·0
Calcium	Ca	40·09	Potassium	K	39·10
Carbon	C	12·00	Praseodymium	Pr	140·6
Cerium	Ce	140·25	Radium	Ra	226·4
Chlorine	Cl	35·46	Rhodium	Rh	102·9
Chromium	Cr	52·0	Rubidium	Rb	85·45
Cobalt	Co	58·97	Ruthenium	Ru	101·7
Columbium	Cb	93·5	Samarium	Sa	150·4
Copper	Cu	63·57	Scandium	Sc	44·1
Dysprosium	Dy	162·5	Selenium	Se	79·2
Erbium	Er	167·4	Silicon	Si	28·3
Europium	Eu	152·0	Silver	Ag	107·88
Fluorine	F	19·0	Sodium	Na	23·00
Gadolinium	Gd	157·3	Strontium	Sr	87·62
Gallium	Ga	69·9	Sulphur	S	32·07
Germanium	Ge	72·5	Tantalum	Ta	181·0
Glucinum	Gl	9·1	Tellurium	Te	127·5
Gold	Au	197·2	Terbium	Tb	159·2
Helium	He	4·0	Thallium	Tl	204·0
Hydrogen	H	1·008	Thorium	Th	232·42
Indium	In	114·8	Thulium	Tm	168·5
Iodine	I	126·92	Tin	Sn	119·0
Iridium	Ir	193·1	Titanium	Ti	48·1
Iron	Fe	55·85	Tungsten	W	184·0
Krypton	Kr	83·0	Uranium	U	238·5
Lanthanum	La	139·0	Vanadium	V	51·2
Lead	Pb	207·10	Xenon	Xe	130·7
Lithium	Li	7·00	Ytterbium (Neoytterbium)	Yb	172·0
Lutecium	Lu	174·0	Yttrium	Y	89·0
Magnesium	Mg	24·32	Zinc	Zn	65·37
Manganese	Mn	54·93	Zirconium	Zr	90·6
Mercury	Hg	200·0			

120 tons of liquid air. Calculated from the densities of the two gases, the atomic weights are Kr = 83·012 and Xe = 130·70.

It will be seen from the evidence given above that few changes are needed in the table of atomic weights. Chromium, 52·01, may be rounded off to 52, as compared with the 52·1 formerly accepted. Arsenic becomes 74·96, in accordance with the work of Baxter and Coffin. The new values for krypton and xenon should also be adopted. As regards mercury, action may be deferred until more evidence is received.

F. W. Clarke.
W. Ostwald.
T. E. Thorpe.
G. Urbain.

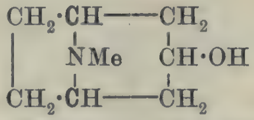
Of the following papers, those marked * were read:

*258. "The resolution of asymmetrical derivatives of phosphoric acid." By Bernard Dunstan Wilkinson Luff and Frederic Stanley Kipping.

A full account was given of the experiments which were briefly described in a preliminary note (this vol., 203).

*259. "The configuration of tropine and ψ-tropine, and the resolution of atropine." By Marmaduke Barrowcliff and Frank Tutin.

Tropine and ψ-tropine both possess a structure indicated by the following formula:



It was considered by Willstätter (*Ber.*, 1900, **33**, 1170) that the difference between these two bases is dependent on the relative positions in space of the hydroxyl and methyl groups.

In view of the fact that the tropine molecule contains two similar asymmetric carbon atoms (shown in heavy type), and could therefore exist in a racemic and an internally compensated form, it was thought that Willstätter's explanation should not be accepted unreservedly without further investigation. Experiments have therefore been conducted on the resolution of tropine and ψ-tropine by fractionally crystallising their salts with certain optically active acids, and it has been shown that both bases are internally compensated, thus confirming the view held by Willstätter regarding their relationship.

Atropine has been resolved by means of its d-*camphorsulphonate*, and salts of both the stereoisomeric hyoscyamines have been isolated in a state of purity. It has been shown that the latter bases, when in the form of their pure salts, have $[\alpha]_D \pm 32{\cdot}1°$, a value considerably higher than has previously been observed for hyoscyamine.

The following new salts were described: *Tropine* d-*camphorsulphonate* (m. p. 236°), *benzoyltropeine* d-*camphorsulphonate* (m. p. 240°), *ψ-tropine* d-*camphorsulphonate* (m. p. 224—226°) and d-*bromocamphorsulphonate* (m. p. 180°), *benzoyl-ψ-tropeine* d-*camphorsulphonate* (m. p. 176—177°) and d-*bromocamphorsulphonate* (m. p. 190°), d- and l-*hyoscyamine* d-*camphorsulphonates* (m. p. 135° and 159° respectively), d-*hyoscyamine auribromide* (m. p. 160°) and *picrate* (m. p. 163°).

DISCUSSION.

Dr. LOWRY inquired whether, apart from the question of optical activity, the isomerism of tropine and ψ-tropine might not be compared with that of borneol and *iso*borneol, depending on the orientation of the CH·OH group relatively to the loops of the ring system.

Dr. W. H. MILLS pointed out that according to Willstätter's formula, although tropine contains two asymmetric carbon atoms, it is necessarily internally compensated and non-resolvable. For since three of the groups attached to the one asymmetric carbon atom are linked to the corresponding groups attached to the other, rearrangement of either of the asymmetric systems with respect to the other (so as to pass from, for example, a + + to a + − form) is impossible. The first asymmetric carbon atom is necessarily the mirror image of the second.

Since the planes of the piperidine and pyrrolidine rings are set at an angle, the relationship between tropine and ψ-tropine may be regarded as a case of *cis-trans*-isomerism, the hydroxyl in the CH·OH group being in the one case on the same side of the plane of the piperidine ring as the pyrrolidine ring, and in the other case on the other side.

Further, as the nitrogen atom is common to two rings lying in two different planes, it, together with its three valencies, will presumably lie in a third plane roughly bisecting the angle between the other two. The nitrogen atom will thus lie out of the plane of the rest of the piperidine ring, and consequently the *cis*- or *trans*-relationship of the hydroxyl group can also be referred to it.

*260. "Adsorption in relation to Gibbs's theory. The mercury adsorbing surface." By William Cudmore McCullagh Lewis.

The author has continued his experiments carried out with a view to verify experimentally Gibbs's expression for adsorption. Determinations were made with aniline, caffeine, mercuric sulphate, and sodium glycocholate. The presence of electrocapillary and electrostatic effects was discussed, and a general application was made to the case of the mercury drop-electrode.

DISCUSSION.

Mr. A. E. DUNSTAN asked the author whether the gelatinisation of the colloidal dyestuffs mentioned by him occurred during the process of dyeing; if so, what was the specific function of the mordant?

Mr. LEWIS, in reply to Dr. Cain as to the rôle of adsorption processes in dyeing, suggested dyeing of fibres as due to simultaneous solubility effects in the bulk of the fibre with adsorption on the surface. That the process of dyeing cannot be simply adsorption is evidenced by the fact that a simple adsorption process in the sense of Gibbs' theory is a reversible one; that is to say, if the fibre colour were simply due to adsorption, repeated washing should remove it. The fastness is probably due to gelatinisation (an irreversible process) on the surface of the fibre.

261. "The electromotive behaviour of cuprous oxide and cupric hydroxide in alkaline electrolytes." By Arthur John Allmand.

Electrode systems containing copper, cupric hydroxide, and alkali are unstable, owing to the production of cuprous oxide. The following systems are stable: (*a*) $\mathrm{Cu} \mid \mathrm{Cu_2O}$ alkali; (*b*) $\mathrm{Pt} \left| \begin{matrix} \mathrm{Cu(HO)_2} \\ \mathrm{Cu_2O} \end{matrix} \right.$ alkali. The single potential differences involved in these systems were measured. Sodium and potassium hydroxide were used in both *N*- and *N*/10-concentration. The auxiliary electrodes used were calomel (*N* and *N*/10), as hydrogen electrodes are found to behave unsatisfactorily in alkaline electrolytes. From the results of the measurements, the solubility products of cupric hydroxide and cuprous oxide were calculated. Theoretical values for the hydrogen electrode in alkaline solution were assumed, and the *E.M.F.* of the cell

$$\mathrm{Cu} \mid \mathrm{Cu_2O}\ \text{alkali} \left| \begin{matrix} \mathrm{Pt} \\ \mathrm{H_2} \end{matrix} \right.$$

thus obtained. From this was calculated the dissociation pressure of cuprous oxide at the ordinary temperature, and also the temperature at which cuprous oxide will dissociate when heated in air. The figures show satisfactory agreement with those calculated from thermal data by the use of Nernst's theorem. The influence of the size of grain of depolariser on potential measurements was recognised and emphasised.

262. "The stereoisomeric modifications of $\alpha\beta$-dibromobenzylacetophenone." By Ida Smedley.

The action of bromine on benzylideneacetophenone was originally investigated by Claisen (*Ber.*, 1887, **20**, 657), who added a molecular proportion of bromine to one of benzylideneacetophenone in chloroform solution; white needles melting at 157° separated, and were identified as the dibromo-additive product. Subsequently, the preparation of this substance was described by Wislicenus (*Annalen*, 1899, **308**, 219), and later by Ruhemann (*Trans.*, 1904, **85**, 456). The latter observer points out that a better yield of the dibromo-compound is obtained if the bromination is carried out in carbon disulphide solution.

On mixing together molecular proportions of bromine and benzylideneacetophenone in chloroform solution, crystals separated, which melted at 157—158° when recrystallised from alcohol, and were identical with the dibromo-derivative previously described; the yield of this was from 70 to 80 per cent. On further concentrating the solution, white needles melting at 111° crystallised out; recrystallisation from alcohol raised their melting point to 112—113°:

0·1718 gave 0·3033 CO_2 and 0·0512 H_2O. C = 48·15; H = 3·32.
0·2115 ,, 0·2158 AgBr. Br = 43·37.
0·2750 ,, 0·2796 AgBr. Br = 43·28.
$C_{15}H_{12}OBr_2$ requires C = 48·91; H = 3·26; Br = 43·47 per cent.

This compound is therefore isomeric with the benzylideneacetophenone dibromide melting at 157°.

The more soluble isomeride (m. p. 113°) becomes discoloured if the temperature is raised above its melting point, and shows signs of decomposition; after heating for some minutes at 180°, the dark-coloured residue which solidified on cooling was pressed on a porous plate and crystallised from alcohol; white needles were obtained, which melted at 156—157°. The identity of this substance with the less soluble isomeride was confirmed by the mixed melting-point method.

263. "The constituents of the fruit of Ecballium Elaterium."

By Frederick Belding Power and Charles Watson Moore.

The results obtained by an examination of elaterium and of the "elaterin" therein contained (*Pharm. J.*, 1909, [iv], **29**, 501) have led the authors to undertake a complete investigation of the fruits of *Ecballium Elaterium.* One of the objects in view was to ascertain whether any evidence could be obtained in support of the statement by Berg (*Bull. Soc. chim.*, 1897, [iii], **17**, 85) that elaterin exists in these fruits in the form of a glucoside. The expressed juice of the fruit was found to contain, in accordance with a previous observation by Berg (*loc. cit.*), an enzyme which is capable of hydrolysing β-glucosides. For the purpose of a complete investigation, 27 kilograms of the fresh, nearly ripe fruit were employed. The alcoholic extract of this material yielded a quantity of resin, from which the following substances were isolated: a small amount of a hydrocarbon (m. p. 68°); a phytosterol, $C_{27}H_{46}O$ (m. p. 148°; $[\alpha]_D + 3{\cdot}2°$); a substance (m. p. 258—260°) which appears to be related to ipuranol, $C_{23}H_{38}O_2(OH)_2$; a mixture of fatty acids; and a product corresponding to the so-called "elaterin," the characters of which have previously been elucidated by the authors (*loc. cit.*). It is now proposed to designate the lævorotatory constituent of crude elaterin as α-elaterin, and the dextrorotatory, physiologically active constituent as β-elaterin. The portion of the alcoholic extract which was soluble in water contained a quantity of inorganic salts and a sugar which yielded *d*-phenylglucosazone (m. p. 216°). It has been shown that the elaterin exists in *Ecballium* fruits in a free state, not in the form of a glucoside, and no evidence could be obtained of the presence of any glucosidic substance.

264. "3-Nitrodurene." By John Cannell Cain.

As all endeavours to prepare mononitrodurene by the direct nitration of durene have hitherto proved unsuccessful—the dinitro-derivative always being obtained—Willstätter and Kubli have recently (*Ber.*, 1909, **42**, 4151) prepared aminodurene by first converting durene into the monobromo-derivative, then nitrating this to bromonitrodurene which is finally reduced with zinc dust and acetic and hydriodic acids to aminodurene. These authors were able to prove that a small amount of nitrodurene is formed when iododurene is treated with silver nitrite, but as the nitrodurene is accompanied by much unchanged iodo-derivative, it could not be isolated in the pure state.

In continuation of his investigation of the derivatives of durene (*Ber.*, 1895, **28**, 967), the present author, in the year 1895, prepared nitro- and amino-durene, but as the work was interrupted the results were not published.

3-*Nitrodurene*, $C_6HMe_4{\cdot}NO_2$, is readily obtained in good yield by diazotising 3-nitro-6-aminodurene (*loc. cit.*) in alcoholic solution and boiling until no more nitrogen is evolved. The solution is poured into water and distilled in a current of steam, when the pure nitro-hydrocarbon passes over as an oil which, on cooling, solidifies to colourless crystals melting at 70°. On boiling nitrodurene with tin and hydrochloric acid it is reduced to the amino-compound, which was, however, not further characterised.

265. "Chemical affinity and electrons." (Preliminary note.)

By Bernhard Flürscheim.

In a recent paper it has been pointed out that the relations between molecular constitution and dissociation constants do not support the idea that atoms are linked by means of interposed electrons; since numerous organic reactions lead to the same conclusion, the author put forward the following alternative hypothesis:

(1) The atomic mass (or aggregate of positively and negatively charged particles) is surrounded by an ethereal layer or envelope, in which, by the action of free electrons within the atom, the form of energy called chemical affinity is induced similarly to the induction of molecular magnetism through Ampère currents.

(2) The affinity thus induced varies, for different atoms, both in quantity and in quality. Its quantity depends on the capacity of the ethereal envelope, which is proportional to the surface of the uncombined and uncompressed atom. Its quality is a function of the electrical charges within the atom. If the latter contains equal amounts of positive and negative charges, no affinity is induced (inert gases: compare A. Michael, *J. pr. Chem.*, 1903, [ii], **68**, 487). If positive or negative charges are in excess, the induced affinity assumes corresponding polarity. Its specific polarity, that is, the atom's polar affinity (A_p) per unit of its total affinity (A), corresponds with the proportion of the number (n) of excess of electrical charges (e) to the surface of the uncombined atom (s_u): $Ap/A = k \times ne/s_u$. The relative polarity of the atom is its specific polarity, expressed in fractions of maximal, that is electronic, polarity: $A_{pr} = A_p/A \times e$.

(3) When two atoms are combined, their ethereal envelopes are contracted toward the point of linking, as a result of their mutual attraction. Thereby the atomic mass is compressed, until its resistance to compression produces an equilibrium (compare I. Traube, *Ber.*, 1907, **40**, 729). This resistance is a function of the density of the

uncombined atom, $F(d)$, and of its specific polarity, $F_1(A_p/A)$. Between the force of mutual attraction (Q) of two atoms, their uncombined volumes (v_u), and their volumes in combination (v), we accordingly have the relation:

$$v = \frac{k_1 \times v_u \times F(d) \times F_1(A_p/A)}{Q}.$$

Q is the algebraic sum of the forces emanating from the polar (A_p) and non-polar (A_{np}) components of the affinities of the two atoms I and II, and r being the distance of the atomic centres:

$$Q = \frac{k_2 \times A_{np_{\mathrm{I}}} \times A_{np_{\mathrm{II}}} \pm k_3 \times A_{p_{\mathrm{I}}} \times A_{r}{}^{\mathrm{II}}}{r^2}$$

± becomes + for heteropolar and – for isopolar atoms, in which latter case atomic combination may become labile (fluorine) or cease (many metals).

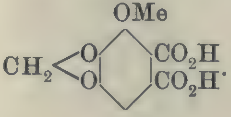
When one atom is linked to several others, Q and v for all are the results of an equilibrium (compare *J. pr. Chem.*, 1907, [ii], **76**, 185).

(4) Atoms transfer their own polarity to other atoms in proportion to the force with which they are linked to them.

(5) These views are supported by ample evidence, especially by the changeable valency of strongly polar atoms, by substitution reactions, molecular volumes, and thermochemical constants. They are capable of throwing new light on various problems. Regarding migration velocity in electrolytes, for instance, it is seen that all existing calculations of ionic hydration based on conductivity measurements require modification; for they all assume that the electrodes attract the constant ionic charges, e, whereas only that part of e which is not bound by the atomic affinity of the solvent and solute can exert any attraction on the electrodes; and this free portion of the electronic charge varies from ion to ion, being the outcome of an equilibrium, as explained above.

266. "Synthesis of cotarnic acid." By William Henry Perkin, jun., Robert Robinson, and Frederick Thomas.

Starting with 5:6-methylenedioxy-1-hydrindone, the authors have succeeded in synthesising cotarnic acid in a way which clearly proves that its constitution is that represented by the usually accepted formula:



267. "The acyl-bornylamines. Part I. Fatty bornylamides." By Percy Faraday Frankland and Fred Barrow.

These compounds have been studied in connexion with the relationship between chemical constitution and optical activity. The authors have prepared the formyl, acetyl, *propionyl*, and n-*butyryl* derivatives, and have determined their rotatory power in methyl and ethyl alcohol, in glacial acetic acid, and in pyridine solution respectively. The formyl and acetyl compounds have been previously prepared and optically examined in ethyl-alcoholic solution by Forster (Trans., 1899, **75**, 934, 1149).

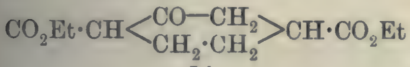
268. "The acyl-bornylamines. Part II. Aromatic bornylamides." By Percy Faraday Frankland and Fred Barrow.

In continuation of the above work (preceding abstract), the authors have prepared the benzoyl, the o-, m- and p-*toluyl*, and the o-, m- and p-*nitrobenzoyl* derivatives. The optical activity was determined in methyl and ethyl alcohol, in glacial acetic acid, and in pyridine solution respectively. The benzoyl compound had been previously prepared by Forster (*Trans.*, 1898, **73**, 393), and its optical activity determined in ethyl-alcoholic solution.

For purposes of comparison, some hitherto unpublished results obtained by one of the authors and Miss M. B. Thomas with the *tartaronitroanilides* (o-, m-, and p-) were described.

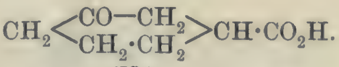
269. "Synthesis of *cyclo*hexanone-3-carboxylic acid." By Mary Elizabeth Dobson, John Ferns, and William Henry Perkin, jun.

The authors have prepared *ethyl pentane-aδδε-tetracarboxylate*, $\mathrm{CO_2Et\cdot CH_2\cdot C(CO_2Et)_2\cdot CH_2\cdot CH_2\cdot CH_2\cdot CO_2Et}$, and find that this ester reacts with sodium with the formation of *ethyl* cyclo*hexanone*-3 : 6-*dicarboxylate* (I):



$$\mathrm{CO_2Et\cdot CH}\!<\!\genfrac{}{}{0pt}{}{\mathrm{CO{-}CH_2}}{\mathrm{CH_2\cdot CH_2}}\!>\!\mathrm{CH\cdot CO_2Et}$$

(I.)



$$\mathrm{CH_2}\!<\!\genfrac{}{}{0pt}{}{\mathrm{CO{-}CH_2}}{\mathrm{CH_2\cdot CH_2}}\!>\!\mathrm{CH\cdot CO_2H}.$$

(II.)

On hydrolysis and elimination of carbon dioxide, this ester yields *cyclo*hexanone-3-carboxylic acid (m. p. 73—75°) (II), which had previously been prepared by Perkin and Tattersall (*Trans.*, 1907, **91**, 480) from *m*-hydroxybenzoic acid by reduction and oxidation of the *cyclo*hexanol-3-carboxylic acid so produced with chromic acid mixture.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Abegg, *Richard*, and **Sackur**, *O*. Physikalisch-Chemische Rechenaufgaben. pp. 104. Leipzig 1909. (*Recd.* 21/10/09.)
From the Publisher: G. J. Göschen.

Hollard, *A*., and **Bertiaux**, *L*. Analyse des métaux par électrolyse. 2nd edition. pp. 256. Paris 1909. (*Recd.* 21/10/09.)
From the Publishers: Messrs. H. Dunod et Pinat.

Mees, *Charles Edward Kenneth*. An atlas of absorption spectra. pp. 74. ill. London 1909. (*Recd.* 30/9/09.) From the Author.

Meyer, *Kirstine*. Temperaturbegrebets Udvikling gennem Tiderne samt dets sammenhæng med vexlende Forestillinger om Varmens Natur. pp. 182. Copenhagen 1909. (*Recd.* 8/9/09.)
From the Author.

Musu-Boy, *Roberto*. Lo Zinco. pp. xvi + 219. ill. Milano 1909. (*Recd.* 21/10/09.) From the Publisher: Ulrico Hoepli.

Richards, *Theodore William*, [and others]. Experimentelle Untersuchungen über Atomgewichte. pp. viii + 890. ill. Hamburg 1909. (*Recd.* 21/10/09.) From the Publisher: Leopold Voss.

Savoia, *Umberto*. Metallografia. pp. xvi + 208. ill. Milano 1909. (*Recd.* 21/10/09.) From the Publisher: Ulrico Hoepli.

II. *By Purchase.*

Handbuch der anorganischen Chemie. Edited by *Richard* **Abegg** and *Fr*. **Auerbach**. Vol. III. Part II. pp. xii + 921. Leipzig 1909. (*Reference.*)

Birckenbach, *L*. Die Untersuchungsmethoden des Wasserstoffperoxyds. (Die chemische Analyse, Vol. VII.) Stuttgart 1909.

PRESENTATION TO PROFESSOR KOERNER.

A Committee has been formed in Milan with the object of celebrating the seventieth birthday of Professor Koerner. It is proposed to devote subscriptions to the following purposes:

1. Foundation of a prize for work in pure and applied chemistry.
2. Reprinting Professor Koerner's works.
3. Presentation of a gold medal to Professor Koerner.

The Treasurer of the Chemical Society will be glad to receive subscriptions, and will forward them to the Organising Committee.

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in December next. Applications for Grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, 6th December, 1909.

All persons who received grants in December, 1908, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Wednesday, 1st December.

The Council wish to draw special attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal tar and allied industries.

At the next Ordinary Scientific Meeting on **Thursday**, December **2nd**, 1909, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"A new method for the detection of sodium, calcium, and rubidium." By W. C. Ball.

"The correction of the specific gravity of liquids for the buoyancy of air." By J. Wade and R. W. Merriman.

"Synthesis with the aid of monochloromethyl ether. Part II. The action of monochloromethyl ether on the sodium derivative of ethyl acetoacetate." By J. L. Simonsen and R. Storey.

"Synthesis of hordenine, the alkaloid from barley." By G. Barger.

"Note on Dr. Scott's paper on the molecular weight of tetraethylammonium bromide and the atomic weight of carbon." By Sir Edward Thorpe.

"The relation between the chemical constitution of monoazo-dyes and their fastness to light." By E. R. Watson, A. C. Sirkar, and J. M. Dutta.

"Synthesis in the epinephrine series." By F. Tutin, F. W. Caton, and A. C. O. Hann.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics.*

The following Candidates have been proposed for election. A ballot will be held on Thursday, December 2nd, 1909.

Aiyer, A. K. Yegna Narayan,
Bangalore, India.

Assistant Chemist, Department of Agriculture, Mysore State. Master of Arts and Gold Medallist in Chemistry of the University of Madras (India) and eight years' experience as Assistant Chemist in the Department of Agriculture, Mysore.

Morris W. Travers.	H. V. Krishnayya.
M. Goolab Roy.	*Claude S. Fawcitt.*

Anklesaria, Jehangir Dhanjishaw,
Ahmedabad, India.

Pharmaceutical Chemist. Minor and Major Qualifications of the Pharmaceutical Society.

Arthur W. Crossley.	Chas. Horne Warner.
Charles Gilling.	*W. Palmer Wynne.*

M. O. Forster.

Armstrong, James Alexander Hadden,
Dumisa, Natal.

Solicitor, Notary Public, Geologist and Metallurgist, presently acting as Metallurgist to the Dumisa Gold Mining Co. The holder of several certificates from Oxford and Cape Universities. Conducted much scientific research. Vide Annals S.A. Association for Advancement of Science (1907). Read a paper before the S.A.

Association on "Diamondiferous and Sedimentary Deposits of Natal."

S. R. Edminson. Carl Lewis.
A. M. Neilson. *E. H. Croghan.*
W. J. Wren.

Barker, Donald William Elsom,

2, Hope Street, Wrexham, N. Wales.

Manufacturing Chemist and Optician. Past Student of Muter's School of Pharmacy. Member of the Pharmaceutical Society of Great Britain. Member of the Society of Chemist Opticians. Have been engaged in Manufacturing and Analytical Chemistry for over twelve years. My desire is to be up to date in the various branches of research work.

John Muter. William D. Rogers.
John T. Fleet. A. H. M. Muter.
Will. F. Mawer.

Baron, Harold, B.Sc.,

21, Underhill Road, East Dulwich, London, S.E.

Chemist, Westinghouse Patent Bureau, 2, Norfolk Street, Strand, W.C. Graduated Bachelor of Science, First Class Honours in Chemistry, Victoria University, 1903; Joint Author of "Formation and Reactions of Imino-compounds, Part I" (*J.C.S.*, 1904); Author of Gartside Report, No. 8, "Chemical Industry on the Continent."

Harold B. Dixon. W. H. Perkin.
Arthur Lapworth. Norman Smith.
H. F. Coward.

Best, Stanley Robert, M.Sc.,

Hope Villa, Wellington Road, Whalley Range, Manchester.

Master of Science, Analyst and Assistant-Manager. Research Assistant to Dr. Jocelyn F. Thorpe, F.R.S., 1908–09, and have published four papers conjointly with him in the Journal of the Society, namely, *Trans.*. 1909, **95**, 8; *ibid.*, 261; *ibid.*, 685; *ibid.*, 1508.

Harold B. Dixon. J. L. Simonsen.
W. H. Perkin. A. N. Meldrum.
J. F. Thorpe. R. Robinson.

Bottomley, Hubert Frederick,

The Cedars, Wavertree Road, South Woodford, Essex.

Chemist. At present and for the past three years engaged as assistant in Chemical and Bacteriological research in connexion with

Sanitary Chemistry for the Sanitas Co., Ltd., London. Previous to the above I assisted in experiments on the Chemical and Bacterial treatment of Sewage at Huddersfield.

C. T. Kingzett, W. E. Speight.
R. C. Woodcock. James Bruce.
R. M. Harland.

Breakspear, Henry Shaw,

20, Walton Well Road, Oxford.

Science Master. B.A. (Oxon.), Honours in Chemistry.

W. W. Fisher. N. V. Sidgwick.
Allan F. Walden. T. S. Moore.
F. D. Chattaway.

Burger, Dr. O. K. H.,

4, Mission Row, Calcutta.

Analytical and Consulting Chemist. Ph.D. (Munich). Assistant at the Chemical Laboratory of the State in Munich (January, 1906–October, 1907). Publications: Author of several communications on Inorganic Chemistry, published in the *Berichte der deutschen Chemischen Gesellschaft.* Wishes to keep in touch with current literature while in India.

E. Sommerfeldt. Adolf von Baeyer.
Paul Brühl. William Tate.
R. Willstätter. *W. H. Perkin.*

Bury, Frank Ward,

Lyndale Cottage, Darwen, Lancs.

Science Teacher, Hebden Bridge Secondary School, Yorks. B.Sc. Manchester. Teacher in Chemistry. Desire to keep abreast of researches in Chemistry.

Harold B. Dixon. H. F. Coward.
W. H. Perkin. R. Robinson.
Norman Smith. *Arthur Lapworth.*

Callister, William Edward, B.Sc. (Manc.), L.C.P.,

The Rowans, Onchan, Isle of Man.

Science Master, Douglas Secondary School. Assistant Science Master and Teacher of Chemistry at St. Margaret's Secondary School, Manchester, 1902–1904. Senior Science Master and Teacher of Chemistry at the Douglas Secondary School, Isle of Man, 1904 to present time.

Fred. R. Grundey. *Frank Dixon.*
R. L. Taylor. *J. L. Simonsen.*
H. F. Coward. *W. H. Perkin.*

Carey, William Gordon,

"Wyngarth," Harpenden, Herts.

Analytical Chemist. Certificated Day Student in Chemical Department at City and Guilds Technical College, Finsbury (1901–1904). Analytical Chemist to the Clinical Research Association (1904–1909). Associate of Institute of Chemistry (Branch E).

R. Bodmer. J. S. H. Walker.
Charles A. Keane. *A. Prideaux Davson.*
Edward Hinks.

Chamblis, Hardee,

56 W. 36th St., New York City, U.S.A.

Chemist for past six years on the Research Staff of the General Chemical Company, New York. M. S. Vanderbilt University (1899), where I was Scholastic Fellow. Ph.D. Johns Hopkins University (1900). Dissertation, "The Permanganates of Mg, Zn, and Ca." Assistant in Chemistry, Columbia University, New York City (1900–01). Chemist, Moore Electrical Company, Newark, N.J., Patentees of More Tube Lights.

T. Lynton Briggs. Friend E. Clark.
Wm. L. Dudley. Chas. Baskerville.
H. T. Vulté.

Chand, Lakshami,

c/o Messrs. Ramchand, Bulaki das Naudau Sahni Street,
Benares City, U.P. India.

Student of the Municipal School of Technology, Victoria University. Manchester. B.A. of Allahabad University in English literature, B.Sc. (Tech.) of Victora University, Manchester. Desirous of keeping in touch with modern chemical research.

E. L. Rhead. S. J. Peachey.
F. G. Richards. Jas. Grant.
C. Stanley Gibson.

Dawson, James Ferguson,

Glencoe House, Tarbert, Loch Fyne, N.B.

Science Master. Bachelor of Science of the Manchester University. Science Master in the Higher Grade School, Tarbert, Loch Fyne, Scotland. Late Junior Science Master in the Academy, Alloa.

Harold B. Dixon. W. H. Perkin.
H. F. Coward. J. F. Thorpe.
R. Robinson.

Dunningham, Alfred Charles,

28, Victoria Road, Northwich, Cheshire.

Schoolmaster (Science). Student at University College, London

(October, 1904—March, 1908). Internal Graduate in Science, of London University, with 2nd Class honours in Chemistry. At present Science Master in Sir John Deane's Grammar School, Northwich.

R. W. Gray. Samuel Smiles.
N. T. M. Wilsmore. E. de Barry Barnett.
Edward C. Cyril Baly.

Edgar, Edward Charles, D.Sc.,

Dalegarth, Romiley, Cheshire.

Lecturer in Chemistry in the Manchester University. Joint author, with Prof. Dixon, of memoir on "The Atomic Weight of Chlorine," *Phil. Trans.* R.S., 1905, and author of second memoir on "The Atomic Weight of Chlorine," *Phil. Trans.*, 1908.

Harold B. Dixon. Norman Smith.
W. H. Perkin. H. F. Coward.
Arthur Lapworth. W. N. Haworth.
R. Robinson.

Edge, Alfred,

Ravenhurst, Clayton Bridge, Manchester.

Technical Chemist to the Berlin Aniline Co., Limited. Student for the full course at the Municipal Technical School, Manchester, and for two years at the Owens College, Manchester. Demonstrator in the Chemical Dept. Manchester Technical School. Works chemist at Messrs. J. Mandleberg & Sons, Rubber Manufacturers, Pendleton, Manchester, and as above.

E. L. Rhead. Jas. Grant.
F. G. Richards. Jul. Hübner.
F. S. Sinnatt. *C. Stanley Gibson.*
S. J. Peachey.

Edwards, Frederick Watson,

64, Coppice Side, Swadlincote.

Photographer and Journalist. Contributions to Photo-chemical Science in *The Amateur Photographer* and *The Practical Photographer*: "Prussian Blue and Turnbull's Blue: Their Application in Photography"; "The Theory and Practice of Gold Toning"; "Pigments and Dyes: Their Application in Photography"; "A Ferrocyanotype Process"; "Factorial Development with Ferrous Oxalate"; "The Ferrous Oxalate Developer"; "On Tinting Negatives"; "Hardening Negatives." Lectured on Radium, Polonium, and Photo-chemical subjects before Burton Natural History Society and the local Photographic Societies.

Arthur Slator. Jas. O'Sullivan.
S. L. Courtauld. *Chas. Geo. Matthews.*
A. L. Stern.

Ewins, Arthur James,

7, Towton Road, West Norwood, S.E.

Research Chemist. B.Sc. (Lond.); joint author (with G. Barger) of various papers in the *Trans. Chem. Soc.* during the last four years.

George Barger. J. Bernard Coleman.
George Stanley Walpole. J. C. Crocker.
F. H. Lowe.

Forrester, George Peters,

69, Beck Strasse, Darmstadt (Germany).

Member of the Scientific Staff of E. Merck. Studied at University of Heidelberg, 1904–1906, under Professors Curtius, Bredig, Quincke, Pfitzer, Jannasch, Stollé, Glück, Neumann. Passed German Pharmaceutical State Examination with Note I. Collaborated with Mr. Peter MacEwan in communication to the International Congress of Applied Chemistry on "Variations in the Activity of Certain Toxic Drugs." Elected Continental Secretary of the Commission to give effect to the Congress resolution on the subject.

Peter MacEwan. *N. H. Martin.*
C. R. Hennings. *E. F. Harrison.*
Leonard Dobbin. *F. B. Power.*

Forshaw, Arthur,

104, Holly Road, Handsworth, Birmingham.

Research Chemist, John Wright and Eagle Range Co., Essex Works, Birmingham. M.Sc., Honours in Chemistry (Manchester). Late Fellow of Leeds University. Author of memoir on "Efficiency of Different Gases for Illuminating Power," *Trans. Inst. Gas Engineers.*

Harold B. Dixon. J. F. Thorpe.
W. H. Perkin. J. L. Simonsen.
Norman Smith. R. Robinson.
Arthur Lapworth.

Freymuth, William Adolf,

Rangoon, Burma, India.

Analytical and Consulting Chemist in Rangoon, Burma, India. Preliminary chemical training under C. M. Stuart, Esq.; two years

Charlottenburg not completed, lack of money; some research under Stuart; Metallurgy under H. L. Sulman, Esq.; eight years' service with Sulman and Picard; special jobs, Cyanide Chemistry, Hungary, Venezuela, Italy. Sent to Moreing, Frecheville, Curle, etc., as Metallurgical Assistant on mine examinations. Metallurgical Process Research under Sulman and Picard. Management of Exploration Company, Burma, five years. Assoc. Member Institute of Mining and Metallurgy. Last two years spent on research in manufacture of lac. Discovery of greatly improved process of manufacture of refined lac. This and other manufacturing processes now under management in Rangoon and Calcutta.

Charles M. Stuart.	Thos. R. Duggan.
Frank L. Teed.	*H. Mansfield.*

M. Kemp-Welch.

Fürstenhagen, Otto,

28, Schlesische Strasse, Berlin, S.O.

Technical Chemist to the Actien-Gesellschaft für Anilin Fabrikation, Berlin. Publications: "The Theory of Dyeing," "A New Group of Wool Dyes," "Some New Colouring Matters," "Some New Cotton Dyes," etc.

Jul. Hübner.	*E. L. Rhead.*
J. R. Appleyard.	*S. J. Peachey.*
C. Rawson.	*F. G. Richards.*
Walter M. Gardner.	*F. S. Sinnatt.*
C. Stanley Gibson.	*Jas. Grant.*

Furneaux, George Pomeroy,

"Harbour View," Brixham, S. Devon.

Science Master at Tettenhall College, Staffordshire. B.A. (Oxon.), Second Class Honours (Chemistry).

W. W. Fisher.	H. Brereton Baker.
Allan F. Walden.	Andrea Angel.

N. V. Sidgwick.

Gardiner, Alexander David,

6, Wellfield Terrace, Springburn, Glasgow.

Analytical Chemist. Studied Chemistry, Metallurgy, and Bacteriology at the Glasgow and West of Scotland Technical College. For the last nine years Assistant to F. W. Harris, Esq., F.I.C., Public Analyst for Glasgow.

F. W. Harris.	T. Cockburn.
Thomas Gray.	Andrew S. Matchet.

A. Humboldt Sexton.

Gardner, Henry Dent, jun., M.Sc.,

Fairmead, The Goffs, Eastbourne.

Research Chemist. Passed B.Sc. and M.Sc. Examinations in Chemistry of University of Manchester. Joint author of "Researches on Anthraquinones and Phthaleins," in *Journal Chemical Society*, 1907.

Harold B. Dixon.
W. H. Perkin.
A. N. Meldrum.
H. F. Coward.
J. L. Simonsen.
R. Robinson.

Harding, Victor John, M.Sc.,

Lonsdale Terrace, Whitefield, Manchester.

Research Chemist. B.Sc. Manchester. 1st Class Honours in Chemistry, 1906. M.Sc. 1907. University Scholar and Beyer Fellow. Joint author of "Experiments on the Synthesis of Hexylidene-acetic Acid, Part II," and of other papers in *Journal of Chemical Society*.

Harold B. Dixon.
W. H. Perkin.
Norman Smith.
R. Robinson.
H. F. Coward.
W. N. Haworth.
Arthur Lapworth.

Harvey, Arthur John,

88A, East India Dock Road, Poplar.

Assistant Chemist to Messrs. E. Cook & Co., Ltd., Bow (Soapmakers), and Lecturer on "Soap Manufacture" at East Ham Technical College. First Class Certificate and Bronze Medal "Soap Manufacture" City and Guilds, London. First Class Certificates, Stage III, Board of Education, both Inorganic and Organic Chemistry. Member of the Society of Chemical Industry.

A. E. Dunstan.
W. H. Barker.
R. W. Wilson.
F. Henry Streatfeild.
George Dean.
S. Godfrey Hall.

Hendry, Robert Douglas,

3, Glebe Terrace, Alloa.

Chemist and Manager of Dyeworks. Trained as Chemist at Nottingham University College; Chemist and Manager for twelve years to Messrs. John Paton, Son & Co., Ltd., Alloa. Has specially studied Chemistry in its relation to wool and colour, and lectured on these and allied subjects. Wishes to become a Fellow for the purpose of keeping in touch with the latest thought and methods in the chemical world.

Wm. B. Jackson.
Alec B. Steven.
F. W. Harris.
Thomas Gray.
William S. Denham.

Holmyard, Eric John,

7, Manor Street, Cambridge (Sidney Sussex Coll.).

University Undergraduate in Science. Keenly interested in Chemical Research and Chemistry generally. Intend to specialise in Chemistry.

F. W. Dootson.	C. Stanley Gibson.
A. E. Bellars.	J. G. M. Dunlop.
H. O. Jones.	H. J. H. Fenton.

Leech, Benjamin,

Beech Knoll, Macclesfield.

Dyer and Chemist. M.A. Cantab. (Nat. Sci. Trip., Pt. I, 1899; Pt. II, 1900). Formerly Scholar of Clare Coll., Cambridge.

Horatio Ballantyne.	H. J. H. Fenton.
S. Ruhemann.	H. O. Jones.

William H. Ballantyne.

Lewis, William Cudmore McCullagh,

Garmoyle, Bangor, Ireland. London Address: Chem. Lab., University College, Gower Street, W.C.

Student. Degree: M.A. (R.U.I.). Queen's College, Belfast; Liverpool University; Heidelberg University; University College, London. Publications: "Adsorption in Relation to Gibbs Theory," *Phil. Mag.*, April (1908); "On Sodium Glycocholate," *Biochem. Journal*, Vol. III, No. 3 (1908); "Adsorption" (second paper), *Phil. Mag.*, April (1909); "Zur elektrischen Ladung der Silberkolloide," *Zeitsch. für Kolloide*, Bd. IV., Heft 5; "Oel Wasser Emulsionen," *Zeitsch. für Kolloide*, Bd. IV., Heft 5, 1909.

William Ramsay.	F. G. Donnan.
Edmund Albert Letts.	A. J. Allmand.
J. Norman Collie.	N. T. M. Wilsmore.

Lundholm, Carl Olof, F.I.C.,

2, Eton Avenue, Hampstead, N.W.

Consulting Chemist to the Nobel Dynamite Trust. Diploma as Chemical Engineer from the Technical High School, Stockholm, 1870. Publication in *Teknisk Tidskrift*, Stockholm: "Manufacture of Fulminate of Mercury." Chemist to Nobel's Explosives Co., Ltd., from October, 1878 to May, 1889. Works Manager, Nobel's Explosives Co., Ardeer Factory, from 1/6/89 to 30/6/09.

T. E. Thorpe.	Otto Hehner.
Henry de Mosenthal.	Oscar Guttmann.
Alfred Gordon Salamon	*Arthur R. Ling.*

B. E. R. Newlands.

Norris, Roland Victor,

1, Howe Street, Higher Broughton, Manchester.

Schunck Research Assistant in Chemistry, Manchester University. B.Sc. (Honours) 1908, M.Sc. 1909. Joint author of papers on the "Derivatives of Naphthacene-quinone" and of "Anthraquinone," in the *Journal of Chemical Society.*

Harold B. Dixon.	Norman Smith.
W. H. Perkin.	H. F. Coward.

R. Robinson.

Ping, Francis Hugh,

10, Forest Place, Whipps Cross Road, Leytonstone, N.E.

Teacher. Associate of the Royal College of Science (in Chemistry), 1904–07. Science Master in Jamaica College, Kingston, Jamaica, 1908–1909 (May).

M. O. Forster.	Chapman Jones.
James C. Philip.	G. T. Morgan.

William A. Tilden.

Proud, Charles,

12, Chancellor Road, Southend-on-Sea.

Teacher of Chemistry. Teacher of Chemistry at Technical School, Southend, seven years. Science Student at Univ. Coll., Nottingham, three years. Student of Chemistry at the East London College since Jan., 1909.

F. Stanley Kipping.	J. T. Hewitt.
Clarence Smith.	F. G. Pope.

J. J. Fox.

Ritchings, Walter,

89, Rosehill Road, Burnley.

Science Master, Burnley Gram. Sch. Lecturer in Inorganic and Organic Chem., Burnley Tech. Institute. Degree of M.Sc. Manch., with First Class Honours in Chemistry. Woodiwiss Exhibitioner in Inorg. Chem., Owens College, 1902. Science Master at Burnley Gram. Sch. for five years. Lecturer in Hons. Chemistry, Burnley Tech. Sch., three years.

Harold B. Dixon.	R. Robinson.
W. H. Perkin.	W. N. Haworth.
J. F. Thorpe.	*A. N. Meldrum.*
H. F. Coward.	*F. Thomas.*

Robinson, Frederic William,

Grove House, Farnworth, Widnes.

Research Student. B.Sc., First Class Honours, Chemistry (Liverpool). Research on Double and Triple Ferrocyanides.

J. Campbell Brown. W. Collingwood Williams.
Henry Bassett, jun. A. W. Titherley.
F. G. Donnan.

Sabherwal, Pindi Das,

Bhera (Panjab), India.

Student, University College, Reading. Cambridge University Diploma in Agriculture. Oxford and Reading Joint Committee (Diploma in Agriculture). Passed General Chemistry in Part I, and Agricultural Chemistry in Part II, of National Diploma in Agriculture.

J. K. H. Inglis. John W. Taylor.
E. K. Hanson. J. W. Dodgson.
W. W. Fisher.

Sinha, Manindra,

Calcutta, India.

Senior Demonstrator in Chemistry, St. Xavier's College, Calcutta, India. A graduate (with special mention in Chemistry), Senior Demonstrator in Chemistry, St. Xavier's College. Member Calcutta Chemical Club (under the Presidentship of Dr. P. C. Rây).

P. C. Rây. Haradhan Ray.
Atul Chandra Ganguli. Punchãnan Neogi.
Bidhu Bhushan Dutt.

Stanford, Spencer Boyd Oortis-,

Glenwood, Dalmuir, Dumbartonshire.

Chemical Manufacturer (Works address: 123, Mansion Street, Possilpark, Glasgow). Studied Chemistry at the Glasgow and West of Scotland Technical College; afterwards Assistant Analyst in the Glasgow Corporation Chemical Laboratory. For five years I was Chief Chemist and Assistant Manager of the Glasgow Corporation Sewage Department. At present senior partner of the firm of Stanford and Wylie, Chemical Manufacturers, Glasgow. Desirous of becoming a member of the Chemical Society to keep myself in touch with the progress of Manufacturing and Scientific Chemistry.

Wm. B. Jackson. Thomas Tyrer.
F. W. Harris. *D. Lloyd Howard.*
T. Cockburn. *John C. Umney.*
Chas. Umney.

Stephenson, Guy,

Alexandra Terrace, Crook, County of Durham.

Analytical Chemist. Studied Analytical Chemistry for four years under Messrs. Pattinson and Stead, Middlesbro'. Had charge of laboratory for six years, at Crook. Chief Chemist to Messrs. Pease and Partners, Ltd., Crook, for six years. Nature of work: Analysis of the following—Coke, Coal, Ironstone, Limestone, Fire Clay, Bricks, etc.; all the Tar Products made on the Plant. Water Analysis; and Chemical supervision of the working of the various plants.

J. C. Stead. Ernest W. Jackson.
H. Frankland. Alfred Hutchinson.
William A. Bone.

Stones, George Bertram,

Bank Villas, Tyldesley, near Manchester.

Teacher of Chemistry. M.Sc. (Victoria University, Manchester). One year Private Assistant to Prof. W. H. Perkin, Victoria University, Manchester. Teacher of Chemistry at Bablake Secondary School, Coventry, since September, 1906.

W. H. Perkin. R. Robinson.
J. L. Simonsen. W. N. Haworth.
J. F. Thorpe. H. F. Coward.

Strachan, James Thallon,

10, Nelson Street, Sunderland.

Technical Chemist. Student at Heriot-Watt College (Evening Chemistry Classes), Edinburgh (1898–1902); Assistant Chemist in laboratory of J. and G. Cox, Ltd., Glue and Gelatine Manufacturers, Gorgie Mills, Edinburgh (Sept., 1901, to Oct., 1903); Day Student at Heriot-Watt College, Edinburgh (Oct., 1903, to Nov., 1906); Courses in Chemistry: Inorganic, Organic, Physical and Technical (Theor. and Pract.); Advanced Sound, Light and Heat, and Electricity and Magnetism (Theor. and Pract.); Advanced Mathematics (Pure and Applied); Short Course in Microscopical and Bacteriological work (Edinburgh University Higher Prelim.). Demonstrator in Chemistry to First Year Evening Class Students, Heriot-Watt College (Oct., 1903, to Nov., 1906). Demonstrator in Chemistry to First Year Day Class Students, Heriot-Watt College (Nov., 1905, to Nov., 1906). Chemist, Hendon Paper Works Co., Ltd., Sunderland (since Nov. 1906). Elected Member of Society of Chemical Industry (April, 1909). Desirous of keeping in touch with all the recent developments in Chemical Science.

J. Gibson. C. F. Baker.
J. P. Longstaff. Chas. Meads.
A. P. Laurie. *Leonard Dobbin.*

Taplin, Edward Walter,

Church House, Heavitree, Exeter.

Brewer and Brewer's Chemist. For the past eleven years have been engaged as a Brewer and Brewer's Chemist and Analyst. Hold the Silver Medal in Honours (Full Technological Certificate) of the City and Guilds of London Institute's Examination in Brewing. Two pupils of mine have also taken the Silver Medal in Honours. Am interested in Manufacturing Chemistry generally, especially as applied to brewing and the carbohydrates, and desire to keep in touch with current developments in Chemistry.

F. W. Brown.
Alfred C. Young.
Alf. Chaston Chapman.
A. J. Murphy.
Arthur Smithells.
Thomas Fairley.
H. W. Watson.
B. A. Burrell.

Thoms, Professor Dr. Hermann,

Berlin-Steglitz, Hohenzollernstr. 3.

Universitätsprofessor. Direktor des Königlichen Pharmazeutischen Instituts der Universität Berlin, als solcher verpflichtet Vorlesungen über Pharmazeutische Chemie, Toxikologische Chemie ü. Nahrungsmittelchemie zu halten.

Frederick B. Power.
Frank Tutin.
Peter MacEwan.
W. L. Howie.
E. F. Harrison.

Tingle, Joseph Grantley,

Nauru, Marshall Islands, Central Pacific.

Chemist on Nauru to the Pacific Phosphate Co., Ltd., Leadenhall Street, London; Melbourne and Sydney. Many years engaged in analytical and other chemical work in London, India, Australia, and the phosphate islands of the Pacific.

E. F. Harrison.
Peter MacEwan.
E. J. Millard.
W. Phillip Want.
C. Edwd. Sage.
John C. Hewlett.

Tizard, Henry Thomas,

23, Geneva Road, Kingston-on-Thames.

B.A. Oxford, 1908. Engaged in Research in Chemistry.

D. H. Nagel.
N. Garrod Thomas.
Harold Hartley.
Allan F. Walden.
J. E. Marsh.
F. D. Chattaway.
N. V. Sidgwick.
T. S. Moore.
D. L. Chapman.

Turner, Herbert,

217, Middleton Street, Moss Side, Manchester.

Form Master; Certificated Teacher, St. Margaret's Higher Elementary School, Manchester. Bachelor of Science (Physics and Chemistry) Univ. of Manchester. In addition to usual three years' training, also two years' special work in Chemistry and Physics at the Manchester University and School of Technology. Two years' work in the University of Leeds in classes specially conducted for the training of Science-teachers.

R. L. Taylor. Harold B. Dixon.
G. H. Bailey. *W. H. Perkin.*
J. L. Simonsen.

Van Essen, Everard Cecil,

28, Hereford Road, Snaresbrook, N.E.

Analytical and Technical Chemist. Chemist since 1905 to Messrs. Hemingway and Co., Colour and Chemical Manufacturers, Marshgate Lane, Stratford, London, E. Formerly (1902–1905) Chief Assistant to Arthur P. Strohmenger, Esq., Analytical Chemist and Electrometallurgist, Caxton House, Westminster, S.W.

A. M. Glass. Arthur P. Strohmenger.
Frank Hemingway. *B. E. R. Newlands.*
Stanley J. Peachey. *Watson Smith.*
Bernard Dyer.

Waliaschko, Nikolai,

Hohenzollernstr. 12, II, l., Leipzig, Deutschland.

Magister der Pharmacie und Magistrant der Chemie der Universität, Charkoff (Russland). Als Privatdozent der Chemie und Pharmacie hat der Unterzeichnete die Vorlesungen über die Pharmazeutische Chemie, über die Organische Chemie und über die Stereochemie in Jahren 1906–8 in der Universität Charkoff gehalten. *Gedrückte Arbeiten*: "Ueber das Adonidin Pharmaz. Bote" (russisch), 1902; "Ueber die Konstitution der Flavone," *Travaux de la Société des Sciences physico-chimiques à l'Université de Charkoff*, 1902; "Ueber das Rutin der Gartenraute," Magister-Dissert. *Arch. d. Pharmacie*, 1904; "Ueber das Robinin," *Arch. d. Pharm.* und *Journal de la Société physico-chimique Russe* (Pétersbourg), 1904; "Ueber Folia Digitalis," *Médecin. Journal*, Charkoff (russisch), 1907; "Ueber das Kämpferol aus dem Robinin," *Travaux de la Société des Sciences phys.-chimiques Charkoff*, 1908; "Ueber die Bestandteile der Früchten von Rhamnus cathartica" (mit N. Krassovski), *Journal de la Société physico-chimiques Russe* (Pétersbourg), 1908.

P. W. Robertson.
W. B. Tuck.
J. Lister.
Edward C. Cyril Baly.
F. G. Donnan.

Weizmann, Charles,

57, Birchfields Road, Rusholme, Manchester.

Senior Lecturer in Chemistry in the University of Manchester. Ph.D. Freiburg; D.Sc. Manchester. Author of some twenty papers in the *Journal of Chemical Society* and the *Berichte* on "The Naphthacenequinones and Allied Compounds."

Harold B. Dixon.
Norman Smith.
W. H. Perkin.
H. F. Coward.
Arthur Lapworth.
R. Robinson.

Wheeler, Richard Vernon,

The Colliery House, Altofts.

Chemist to the "British Coal-Dust Experiments" Committee. D.Sc. University of Manchester. Joint author of following memoirs: "The Combination of Hydrogen and Oxygen in Contact with Heated Surfaces," *Phil. Trans.*, A., 1906; "Slow Oxidation of Methane at Low Temperatures," *J.C.S.*, 1902; Part II., Ditto, 1903; "Combustion of Ethylene," *J.C.S.*, 1904.

Harold B. Dixon.
H. F. Coward.
W. H. Perkin.
R. Robinson.
J. F. Thorpe.
Arthur Lapworth.

Williams, Herbert Ernest,

70, Wellington Road, Charlton, Kent.

Analytical and Manufacturing Chemist. Consulting and Analytical Chemist to John Dewrance, Esq., 165, Great Dover Street, and Chief Chemist of the Albion Chemical Company, Riverside, Charlton, Kent. Have also carried out considerable research on the Compounds of Cyanogen and patentee of a process for the Manufacture of Cyanides.

John M. Dougall.
Arthur H. Coote.
T. Wilton.
Ernest Scott.
Wm. Pearce.

Young, Roland Francis,

c/o Taquah Mining and Expn. Co., Tarkwa, Gold Coast.

Chemist and Metallurgist. Attended three years' course at Finsbury Technical College, 1899–1901, obtaining College certificate. Chemist to Wouldham Cement Co., 1901–03. Assistant Chemist, Gas Light & Coke Co.'s Tar Works, Beckton, 1903–07. Cyanide Asst., Taquah Mining & Expn. Co., 1907–present time. (Acting Cyanide Manager, Abosso G. M. Co., July–December, 1908.)

R. Meldola. R. Lessing.
J. Louis Foucar. F. W. Linch.
W. H. Glover.

The following Certificates have been authorised for presentation to Ballot by the Council under Bye-Law I (3):

Flack, Edmund Victor,

Mayville, Wigtown Road, Green Point.

Government Analyst. Connexion with Analytical Chemistry. Analyst at the Govt. Analytical Laboratory, Cape Town, S. Africa.

George N. Blackshaw.

Muller, John,

Government Analytical Laboratory, Grahamstown, Cape Colony.

Government Analyst, and Public Analyst for Eastern Province of Cape of Good Hope. B.A. of Cape University, 1895. Specialised for nearly six months at request of Government in Agricultural Chemistry in Halle a/S Germany, 1896. Assistant Analyst in Government Analytical Laboratory, Capetown, 1895–1902. Analyst in charge of Government Analytical Laboratory, Grahamstown, Cape Colony, 1902–1909.

Walter D. Severn.

Peixoto, Joãs Cornelio Rodrigues,

52, Rua N.S. Copacabana, Rio de Janeiro, Brazil.

Analytical Chemist. Two years at the Polytechnic School of Rio de Janeiro. Two years at the University of Brussels. Fourteen months at the Institute Meurice of Practical Chemistry, Brussels (Diploma). I desire to keep in touch with recent research work in England.

T. H. Lee.

Tapp, Charles,

Cradock, Cape of Good Hope.

Analytical Chemist. Minor Diploma Pharmaceutical Society of Great Britain. Certificate of the Apothecaries Society, London. Honours in Chemistry, Westminster College, London. Late Assistant

Analyst to Mr. E. G. Hogg, of London. Member South African Pharmaceutical and Chemical Societies.

John Cussons.	*A. John Gregory.*
Thos. H. Moore.	*P. Skinner Clark.*
J. Fred. Davis.	*J. H. Dinwoodie.*

Wright, Joseph Pretty,

883, Burrard Street, Vancouver, British Columbia.

Cement Expert and Tester for the Corporation of the City of Vancouver, British Columbia. Five years as Cement Expert to City of Vancouver. Pharmaceutical Society, England, 1886.

J. O'Sullivan.	*John A. Hall.*

R. CLAY AND SONS, LTD., BREAD STREET HILL, E.C., AND BUNGAY, SUFFOLK

[*Issued* 13/12/09

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 25. No. 363.

Thursday, December 2nd, 1909, at 8.30 p.m., Professor HAROLD B DIXON, F.R.S., President, in the Chair.

Mr. Stanley Okell was formally admitted a Fellow of the Society.

Certificates were read for the first time in favour of Messrs.:

Gilbert Grahame Auchinleck, B.Sc., the Department of Agriculture, Grenada, W.I.
Fred Banister, B.Sc., the Grammar School, Doncaster.
Howard Canton, 2, Gloucester Road, Regent's Park, N.W.
Herbert Hillier Hughes, B.Sc., 22, Ranelagh Road, Tottenham, N.
Douglas Wilshin Murch, Selby House, Victoria Road, Wednesbury.
John James Beaumont Rees, B.Sc., Johannesburg College, S. Africa.

A ballot for the election of Fellows was held, and the following were declared duly elected:

A. K. Yegna Narayan Aiyer, M.A.
Jehangir Dhanjishaw Anklesaria.
James Alexander Hadden Armstrong.
Donald William Elsom Barker.
Harold Baron, B.Sc.
Stanley Robert Best, M.Sc.
Hubert Frederick Bottomley.
Henry Shaw Breakspear, B.A.
O. K. H. Burger, Ph.D.
Frank Ward Bury, B.Sc.
William Edward Callister, B.Sc.
William Gordon Carey.
Hardee Chamblis, M.S., Ph.D.
Lakshami Chand, B.A., B.Sc.
James Ferguson Dawson, B.Sc.
Alfred Charles Dunningham, B.Sc.

Edward Charles Edgar, D.Sc.
Alfred Edge.
Frederick Watson Edwards.
Arthur James Ewins, B.Sc.
Edmund Victor Flack.
George Peters Forrester.
Arthur Forshaw, M.Sc.
William Adolf Freymuth.
Otto Fürstenhagen.
George Pomeroy Furneaux, B.A.
Alexander David Gardiner.
Henry Dent Gardner, jun., M.Sc.
Victor John Harding, M.Sc.
Arthur John Harvey.
Robert Douglas Hendry.
Eric John Holmyard.
Benjamin Leech, M.A.
William Cudmore McCullagh Lewis, M.A.
Carl Olof Lundholm.
John Muller, B.A.
Roland Victor Norris, M.Sc.
Joãs Cornelio Rodrigues Peixoto.
Francis Hugh Ping.
Charles Proud.
Walter Ritchings, M.Sc.
Frederic William Robinson, B.Sc.
Pindi Das Sabherwal.
Manindra Sinha.
Spencer Boyd Oortis-Stanford.
Guy Stephenson.
George Bertram Stones, M.Sc.
James Thallon Strachan.
Edward Walter Taplin.
Charles Tapp.
Hermann Thoms, Ph.D.
Joseph Grantley Tingle.
Henry Thomas Tizard, B.A.
Herbert Turner, B.Sc.
Everard Cecil Van Essen.
Nikolai Waliaschko.
Charles Weizmann, D.Sc., Ph.D.
Richard Vernon Wheeler, D. Sc.
Herbert Ernest Williams.
Joseph Pretty Wright.
Roland Francis Young.

Of the following papers, those marked * were read:

*270. "A new method for the detection of sodium, cæsium, and rubidium." By Walter Craven Ball.

A solution of potassium bismuth nitrite, to which about 1 per cent. of cæsium nitrate has been added, produces a yellow, crystalline precipitate of $9CsNO_2,6NaNO_2,5Bi(NO_2)_3$, with traces of a sodium salt. One part of sodium in presence of several thousands of potassium may thus be detected. Conversely, a solution of sodium bismuth nitrite is an excellent test for cæsium, and also for rubidium, if in not too great dilution.

DISCUSSION.

Mr. GRANT HOOPER said that the author had referred to the precipitate which was thrown down when the reagent was exposed to oxidation by contact with the air, and, in connexion with the quantitative determination of sodium, he desired to ask how this precipitate from the reagent was affected by the 50 per cent. acetone which was used to wash the sodium compound. It appeared as if there was some danger of the sodium, as determined under these conditions, coming out too high, and he observed that the last determination quoted by the author was, in fact, a trifle high.

*271. "Note on Dr. Scott's paper on the molecular weight of tetraethylammonium bromide and the atomic weight of carbon."

By Sir Edward Thorpe, C.B.

In determinations of atomic weight when the utmost attainable precision is aimed at, it is customary to reduce the weighings to what is styled a vacuum standard, and the reduction is almost invariably made by a calculation in which the relative densities of air, of the weights, and of the substance weighed are the data.

Marignac, as far back as 1843, pointed out that in certain cases, more particularly when the substance weighed was in a fine state of sub-division, this method might be attended with error, due to the tendency of finely-divided substances to occlude and condense air.

In a recent paper (*Compt. rend.*, 1909, **149**, 593), Guye and Zachariades have again drawn attention to this circumstance. They state that with certain substances the error may be so considerable as to affect materially the determination of the value of an atomic weight. By weighing successively in air and in a vacuum, the same mass of finely-divided material (from 20 to 50 grams, depending on its density), and comparing the weight so obtained with that deduced by the conventional method of calculation, they found that the method of calculation invariably over-corrects the weight, and that the difference between the weight actually observed and that obtained by calculation may amount to as much as, or even more than, $\frac{3}{10,000}$

The extent of the difference appears to depend on several factors. In the first place, it depends on the density of the salt, salts of low specific gravity always tending to show the greatest variation. But it also depends, and in a greater degree, on the physical state of the salt. Thus in the case of fused potassium chloride (sp. gr. 1·97) the difference shown by the salt in powder was 32 milligr ms per 100 grams; in crystals it was 20 milligrams; in large pieces it was only 5 milligrams. In the case of fused masses of salts of high density, and in that of fused metals, the discrepancy, if observed, is extremely small, and in such cases is practically negligible.

In a recent communication to the Society (*Trans.*, 1909, **95**, 1200), Dr. Scott has given the results of a number of determinations of the molecular weight of tetraethylammonium bromide, from which he has deduced an atomic weight for carbon slightly in excess of that obtained by the combustion of carbon, of graphite, of pure charcoal, and that deduced by physico-chemical methods, all of which agree extremely well among themselves and consistently point to the value C = 12·00.

The author believes the discrepancy observed by Dr. Scott may be largely, if not altogether, accounted for by the circumstance first pointed out by Marignac. Tetraethylammonium bromide is a salt of very low specific gravity (in a private communication Dr. Scott informed the author that he found it to be 1·35), and, as he mentions in his paper, it was employed by him in the state of a fine powder. Tetraethylammonium bromide is not included in the long list of substances experimented upon by Guye and Zachariades, and no direct data exist for determining the precise value of the correction to be applied to its so-called vacuum weight. There is, in fact, no substance in the list of so low a specific gravity as 1·35, but considering the nature of the salt it is reasonably certain that it must be as great as, and in all probability greater than, the maximum value hitherto found. The maximum value obtained by Guye and Zachariades was observed in the case of potassium nitrate (sp. gr. 2·09), namely, 33 milligrams per 100 grams.

To ascertain what might be the influence of Marignac's correction in the case of Dr. Scott's observation, this value of 33 milligrams may be applied. Dr. Scott found that, collectively, 44·17031 grams of tetraethylammonium bromide were equivalent to 22·66675 grams of silver. Applying Guye and Zachariades' number, the aggregate weight of the tetraethylammonium bromide would probably be at most 44·15573 grams, and on the assumption that the atomic weight of silver is 107·88, this would give the molecular weight of the salt as 210·154.

Taking the molecular weight of ammonium bromide as 97·962, on the basis of what is the accumulated testimony of the best determinations of the several atomic weights of its elements, we obtain 112·192 as the molecular weight of C_8H_{16}, whence we have $C = 12{\cdot}008$.

It cannot, therefore, be regarded as established that the weight of the carbon atom in tetraethylammonium bromide, or in the group C_8H_{16}, is different from what it has been found to be in other carbon compounds.

The slight variation which Dr. Scott has observed will, in the author's opinion, be proved to be mainly, if not entirely, dependent upon the physical peculiarities of the salts he has employed.

*272. "The correction of weights of substances weighed in air to weights in a vacuum." By Alexander Scott.

Before passing to the consideration of the work of Marignac and of Guye and Zachariades with reference to corrections to vacuum standards, whether by experiment or by calculation in the ordinary way, the author referred to the note on his determination of the atomic weight of carbon by Sir Edward Thorpe (preceding paper). One point especially emphasised was that the value for C_8H_{16} is based on the difference between the molecular weights of tetraethylammonium bromide and ammonium bromide, both values being determined in the same way, with the same balance, pure silver, and the same set of carefully calibrated weights. It was thus hoped to eliminate any sources of error which might possibly be due either to the method or to personal equation. Therefore, if it is fair to deduct 33 milligrams per 100 grams of tetraethylammonium bromide, as Sir Edward has done, it would only be fair to take at least 22 milligrams from 100 grams of ammonium bromide, which would make for the 97·950 grams, which are equivalent to 107·88 of silver, 97·928 to be subtracted from Sir Edward Thorpe's calculated value of 210·154, and this gives $C = 12·013$ (taking $H = 1·0075$). Furthermore, a similar correction ought to be applied to the combustion of carbon, for if any substance is capable of condensing air in its pores it is carbon. Applying the correction of 33 milligrams per 100 grams to the careful experiments of van der Plaats, with sugar and paper charcoal, we get instead of $C = 12·004$, $C = 11·998$, so that the final effect of applying this correction all round is to increase rather than diminish the difference in the atomic weight of carbon as found by combustion methods and by the author's method.

As pointed out by Sir Edward Thorpe, Marignac (*Bibl. Univ.*, 1843, **46**, 373) stated that there was a slight difference in the value of the correction to vacuum standards as found by the usual method of calculation from a knowledge of the densities of the substances involved and that found by direct weighing of these substances in a vacuum. This, however, is only very slight, as the following table shows. The author has added the last three columns to Marignac's table, taking the best values for the mean densities of the salts, and Marignac's value of 1·2 milligrams for 1 c.c. of air.

Salt.	Weight in air.	Weight in a vacuum.	Weight of equal volume of air.	Density.	Error in milligrams.
$AgClO_3$	100	100·029	0·027	4·43	−2·0
$AgBrO_3$	100	100·021	0·023	5·21	+2·0
$KClO_3$	100	100·054	0·0515	2·33	−2·5
$KBrO_3$	100	100·044	0·0373	3·22	−6·7
KIO_3	100	100·030	0·308	3·89	+0·8
NH_4Cl	100	100·080	0·0792	1·515	−0·8

As Marignac's weighings are only given to milligrams, presumably his balance was only sensible to a milligram, and an examination of the last columns shows, with the one exception of potassium bromate, that the evidence is quite as much against as in favour of his statement that any sensible error exists.

The recent paper of Guye and Zachariades (*Compt. rend.*, 1909, **149**, 593) gives a list of twenty-six substances, with their densities, and the errors stated to occur when 100 grams of each are weighed in air in fine powder and the correction for the displaced air applied in the usual way. This error they, like Marignac, ascribe to air condensed in the pores of the fine powders, although it is difficult to see why "*hygroscopicité*," as stated in their paper, should also enter into the question. These errors range from 33 milligrams in the case of potassium nitrate to only 1 for copper oxide. For potassium chloride they give more data, stating that the errors are 5 milligrams for fused lumps, 22 for crystals, and 32 milligrams for fine powder. This last number means that 32 milligrams, or 27 c.c. of air, are condensed in the pores of 100 grams of finely-powdered potassium chloride, and therefore ought to be evolved with effervescence when the latter is dissolved in ordinary distilled water.

This statement seemed so extraordinary that the author weighed in a vacuum and in air potassium chloride in fused lumps, in crystals, and in fine powder, and observed practically no difference between the weights referred to a vacuum, whether found directly or by the ordinary method of calculation, with this precaution, however, that the calculation was made with the actual density of the air as determined at the time and not an average density as is too often done. The slight differences, which still seem to remain, would be in all probability completely removed had time permitted the preparation of an exact counterpoise to the vessel used to contain the salt. As, however, all this work has been carried out since Sir Edward Thorpe had most courteously sent the author a copy of the note communicated by him to the Society, it has not been possible to employ all the refinements which modern science suggests. The apparatus employed was a large test-tube, with cap carefully ground, and to which was sealed a good glass stopcock, both capable of keeping a vacuum for days, and a small flask similarly fitted. Their volumes were respectively 186·5 and 82·16 c.c. The large tube had to be weighed on a larger and less sensitive balance than the small flask.

	Fused salt.	Salt in crystals.	Salt in fine powder.
Weight of tube, vacuous	101·2616	101·2472	39·0418
,, ,, full of air	101·4876	101·4684	39·1424
,, ,, + KCl	215·5280	202·9178	106·8062
,, ,, + KCl + air	215·6840	203·0776	106·8648
,, KCl in a vacuum	114·2664	101·6706	67·7644
,, ,, in air	114·1964	101·6092	67·7224
,, air displaced	0·0700	0·0614	0·0420
,, air along with KCl	0·1560	0·1598	0·0586
,, total air	0·2260	0·2212	0·1006
,, 1 c.c. of air in milligrams	1·212	1·186	1·23
Calculated correction for air	0·0703	0·0617	0·0423
Density of substance	1·9698	1·9527	1·9702
Error	0·0003	0·0003	0·0003

In addition to the three experiments of which the results are given in the preceding table, two other experiments with crystals and fine powder were made with like results.

Mr. J. D. Kettle, chief assistant at the Davy-Faraday Laboratory, took finely-powdered benzoic acid (a less dense substance than any of the substances mentioned above), and, on fusing 19·8 grams of it in a vacuum and using a tube of approximately the same weight and volume as a counterpoise, was unable on a still more sensitive balance to detect the slightest change in weight, and no trace of gas was given off on fusion which could be detected by a mercury gauge any more than by the balance; as some of the salts in Guye and Zachariades' list were apparently hydrated, perhaps some of their results may have been due to loss of water, otherwise no explanation can be given of their most remarkable results. Until a detailed account of their work, giving the actual weighings, is available, further criticism is hardly called for.

*273. "Synthesis of hordenine, the alkaloid from barley."

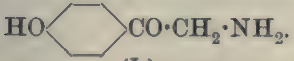
By George Barger.

Hordenine, isolated by Léger (*Compt. rend.*, 1906, **142**, 108) from barley germs, and recognised by him as *p*-hydroxyphenylethyldimethylamine, $OH\cdot C_6H_4\cdot CH_2\cdot CH_2\cdot NMe_2$, has now been synthesised from phenylethyl alcohol, which was successively converted into β-phenylethyl chloride and phenylethyldimethylamine; the phenolic hydroxyl was then introduced by successive nitration, reduction, and diazotisation.

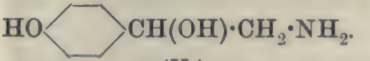
The more obvious synthesis, by methylation of *p*-hydroxyphenylethylamine (Barger, *Trans.*, 1909, **95**, 1123), could not be carried out; by this means only hordenine methiodide was obtainable, but not hordenine itself.

*274. "Syntheses in the epinephrine series." By Frank Tutin, Frederic William Caton, and Archie Cecil Osborn Hann.

The authors have prepared *ω-amino-*p*-hydroxyacetophenone* (I) and *β-*p*-dihydroxy-β-phenylethylamine* (II).



(I.)



(II.)

Both of these compounds, when injected intravenously, considerably increase the blood-pressure. The latter compound, however, is the more powerful, and, in its action, more closely resembles epinephrine.

The formation and properties of the above-mentioned bases (I and II) and of a number of other new compounds were described.

275. "The correction of the specific gravity of liquids for the buoyancy of air." By John Wade and Richard William Merriman.

In determining the specific gravity of liquids to the fifth decimal place, neglect of variations in atmospheric density may lead to serious error, more especially when the water-content of the pyknometer is not determined under the same atmospheric conditions as those obtaining at the time of weighing the liquid. Analysis of the limits of accuracy of the customary correction formula leads to some simple expressions which, with the aid of tabulated constants, materially reduce the labour of correction.

276. "Syntheses with the aid of monochloromethyl ether. Part II. The action of monochloromethyl ether on the sodium derivative of ethyl acetoacetate." By John Lionel Simonsen and Robert Storey.

The authors showed that monochloromethyl ether and ethyl sodioacetoacetate condense with the formation of *ethyl methoxy-β-methoxycrotonate* and ethyl αγ-diacetylglutarate.

277. "The relation between the chemical constitution of monazo-dyes and their fastness to light." By Edwin Roy Watson, A. Chandra Sirkar, and Jatindra M. Dutta.

From rules which had been already formulated by one of the authors (this vol., p. 224) it was expected that the dyes sulphobenzeneazophenolmonosulphonic acid and sulphobenzeneazophenoldisulphonic acid would be very fast to light. This was found to be the case. Sulphobenzeneazophenol was also found to be very fast to light. Contrary to the usual assumption that a hydroxy- or amino-group must be present in an azo-compound to give it dyeing properties, it was found that azobenzenedisulphonic acid is a dye, and, owing to the presence of sulphonic groups and the absence of any hydroxy- or amino-group, it was found to be very fast to light.

It was predicted that phenol would be formed as one of the decomposition products when chrysoidine faded in light, and when this was put to the test phenol was found.

It was also predicted that the introduction of bromine atoms or a nitro-group into the phenolic or arylamino-part of a monazo-dye would increase its fastness to light, and that the fastness to light of aminoazobenzene would depend on the position of the amino-group, *m*-aminoazobenzene being faster than *p*-aminoazobenzene. The fastness to light of the following dyes was compared: aminoazobenzene, benzeneazodibromoaniline; benzeneazophenol, benzeneazonitrophenol; sulphobenzeneazophenol, sulphobenzeneazonitrophenol; *p*-aminoazobenzene, *m*-aminoazobenzene, and *o*-aminoazotoluene. The theory, on which these predictions were based, as to the manner of fading of azo-dyes in light was not confirmed by this investigation to the extent anticipated.

278. "The triazo-group. Part X. Triazoantipyrine."
By Martin Onslow Forster and Robert Müller.

The preparation and properties of triazoantipyrine were described, and attention was drawn to the behaviour which distinguishes it from other triazo-ketones.

279. "Volumetric estimation of sulphates."
By Alec Duncan Mitchell and Clarence Smith.

The method consists essentially of adding a small excess of 2*N*/5-barium chloride solution, destroying mineral acid by sodium acetate, adding excess of *N*/10-ammonium dichromate solution, and making up to 100 c.c.; when the precipitate has settled, 25 c.c. of the clear supernatant liquid are titrated with *N*/20-ferrous ammonium sulphate solution, using potassium ferricyanide as an external indicator.

This has been applied to ammonium sulphate, sodium sulphate, potassium sulphate, zinc sulphate, magnesium sulphate, and copper ammonium sulphate, and gives results accurate to about 0·2 per cent., although in the case of potassium sulphate special precautions have to be adopted to minimise adsorption. Excluding weighings, five determinations may easily be made in a hour.

280. "The colouring matter of cotton flowers. Gossypium herbaceum. Part. II." By Arthur George Perkin.

The flowers of the Egyptian cotton plant, a variety of the *Gossypium herbaceum*, have been found to contain three hitherto unknown glucosides. *Quercimeritrin*, $C_{21}H_{20}O_{12}$, the main constituent, crystallises with $3H_2O$ in small, yellow plates, m. p. 247—249°, dyes mordanted fabrics very similarly to quercetin, and gives with lead acetate an orange-red precipitate. It forms an *octa-acetyl* compound, $C_{21}H_{12}O_{12}(C_2H_3O)_8$, colourless needles, m. p. 214—216°, and is hydrolysed with difficulty according to the equation:

$$C_{21}H_{20}O_{12} + H_2O = C_{15}H_{10}O_7 + C_6H_{12}O_6$$

into quercetin and dextrose (osazone, m. p. 204—205°). iso*Quercitrin*, $C_{21}H_{20}O_{12}$ (dried at 160°), consists of pale yellow needles, m. p. 217—219°, and is readily hydrolysed by acid:

$$C_{21}H_{20}O_{12} + H_2O = C_{15}H_{10}O_7 + C_6H_{12}O_6$$

with formation of quercetin and dextrose, but differs from quercimeritrin in several important respects. With lead acetate it gives a bright yellow precipitate, dyes mordanted fabrics similarly to quercitrin (*Trans.*, 1902, **81**, 480), and is present in the flowers in small amount. The third glucoside, *gossypitrin*, $C_{21}H_{20}O_{13}$ (dried at 160°), pale orange-yellow needles, m. p. about 200—202°, when hydrolysed gives gossypetin and dextrose:

$$C_{21}H_{20}O_{13} + H_2O = C_{15}H_{10}O_8 + C_6H_{12}O_6.$$

It yields a bright red precipitate with lead acetate, and dyes mordanted fabrics. The flowers yielded 1·86 per cent. of yellow colouring matter, consisting of quercetin mixed with about 10 per cent. of gossypetin.

281. "Viscosity and association in binary mixtures of liquids." By George Senter.

In a recent paper (*Trans.*, 1909, **95**, 1556) dealing with the viscosity of binary mixtures of liquids, Dunstan and Thole state that the maxima observed in certain viscosity-concentration curves of such systems "invariably occur at or near points of simple molecular composition," and are connected with the formation of definite chemical compounds between the components of the mixture. In this connexion they refer to the brief discussion of this subject in the author's *Outlines of Physical Chemistry* (p. 305—306), in which it is stated that no general agreement has yet been reached with reference to the interpretation of such curves, and they suggest that the considerations there advanced present no obstacle to the general acceptance of the association explanation of the phenomenon.

The experimental work described by Dunstan and Thole was undertaken with the object of throwing light on the displacement of the maxima with temperature, but, unfortunately, observations have only been made over a range of 10° (20—30°), which is too small to allow of any very definite conclusions being drawn. However, it is known from the observations of Arrhenius, quoted in the paper, that in mixtures of ethyl alcohol and water, the viscosity maximum at 0° occurs at a composition of 36 per cent. of alcohol and at 55° at 50 per cent. of alcohol, so that there is an undoubted shift of the maximum with temperature in this case, and doubtless in other cases.

Dunstan and Thole now maintain that such a shift of the maximum does not disprove the association explanation of this phenomenon, and with this the author agrees. It does, however, entirely disprove the suggestion that such maxima invariably occur "at" points of simple molecular composition, since the position of the maximum in the case cited alters continuously with rise of temperature through a wide range of concentration. The qualifying word "near" does not seem to have any well-defined meaning in the present case, as a mixture of two components in any proportions whatever may be looked upon as being "near" a point of simple molecular composition.

Even if the association explanation of the maxima be accepted, it is improbable that the observations throw any light on the composition of the compounds unless the latter are exceptionally stable, like $H_2SO_4(H_2O,SO_3)$ and H_2SO_4,H_2O. In this connexion it is suggestive to note that, according to Kremann (*Monatsh.*, 1907, **28**, 831), the viscosity curve of the system *m*-cresol–aniline, at 0°, shows a maximum at 85 mol. per cent. of the former, although the components only form one compound, containing one molecule of each. Similarly, the viscosity curve of the system phenol–aniline shows a maximum at 67 mol. per cent. of phenol, although only one compound is known containing the components in molecular proportions.

The numerous investigations on alloys carried out in recent years appear to throw some light on this question. According to Tammann (*Zeitsch. anorg. Chem.*, 1907, **53**, 446), it is a general rule that metals belonging to the same natural group form solid solutions (mixed crystals), but no chemical compounds. Now Kurnakoff and Schemtschuschny (*Zeitsch. anorg. Chem.*, 1908, **60**, 1) have shown with reference to the hardness of binary systems (a property allied to viscosity) (1) that the hardness of an unbroken series of solid solutions is often represented by a continuous curve showing a maximum; (2) that a chemical compound may be harder or softer than either of the components. It is not improbable that similar rules may apply to the viscosity of liquid mixtures. There does not seem to be any reason to assume a priori that the viscosity of a compound must be greater than that of its components, especially if the latter are themselves associated.

With reference to the two systems showing maxima specially dealt with in the paper by Dunstan and Thole, cited above, it may be noted that the freezing-point curve of mixtures of acetic acid and water shows no indications of the presence of a compound (Kremann, *Monatsh.*, 1907, **28**, 893), although the observations were made at a lower temperature than the viscosity measurements described in the paper. Moreover, Jones (*Zeitsch. physikal. Chem.*, 1894, **13**, 419) has shown that mixtures of ethyl alcohol and water exert their effect on the freezing point of acetic acid quite independently; he thus obtained no evidence of combination between the first two compounds, although the corresponding experiments with mixtures of sulphuric acid and water showed quite conclusively the formation of compounds.

The fact that the maxima on the viscosity curves become less distinct the higher the temperature does not appear very conclusive from the point of view of association, as it is a rule of very wide applicability that the simple laws (in this case, the mixture law) are followed the more closely the higher the temperature.

Among the factors which have to be taken into account in discussing the properties of binary systems are to be considered, besides possible chemical combination, alterations in molecular complexity and attractions between the molecules (analogous to the a/v^2 term of van der Waals' equation) connected with alterations of "internal pressure" (compare Tammann, *Innere Kräfte und Eigenschaften der Lösungen*, Leipzig, 1907). These factors may be more or less connected, but, on the other hand, the existence of unimolecular liquids indicates that there may be considerable attraction (measured by the term a/v^2) between molecules without leading to chemical combination.

The general conclusion is that at present there are no means of reaching a definite decision on this matter, and we have to depend on rather uncertain criteria which do not all point in the same direction.

282. "Preparation of anhydrides by the action of thionyl chloride on salts of organic acids." (Preliminary note.) By William Smith Denham.

The author has shown (*Trans.*, 1909, **95**, 1235) that sulphur monochloride acts readily on the sodium or silver salts of organic acids in presence of indifferent solvents, forming unstable sulphur compounds of the type $(R{\cdot}CO_2)_2S_2$, which, on spontaneous decomposition, give anhydrides of the acids, together with sulphur dioxide and sulphur.

Since, according to one view, thionyl chloride has a constitution similar to that of sulphur monochloride, attempts have now been made to obtain compounds of the type $(R{\cdot}CO_2)_2SO$ by the substitution of thionyl chloride in the above reaction. Intermediate compounds of this type were not obtained, but it was found that reaction takes place smoothly and readily between typical silver salts and thionyl chloride, with evolution of sulphur dioxide and formation of the acid anhydride, probably according to the equation: $2R{\cdot}CO_2Ag + SOCl_2 = (R{\cdot}CO)_2O + SO_2 + AgCl$. As in this case sulphur dioxide is the only product in addition to the anhydride, this modification of the reaction possesses obvious advantages as a method of preparing anhydrides over that in which sulphur chloride is used. The reaction is carried out as described in the case of sulphur chloride, that is, by adding thionyl chloride dissolved in dry ether to a slight excess of the silver salt suspended in the same solvent, the containing vessel being cooled if necessary. After filtration from silver chloride and distillation of the ether, the anhydride is left in good yield, and generally nearly pure. In this way, acetic, benzoic, and succinic anhydrides have already been obtained.

Whilst sulphur chloride does not, under these conditions, react with silver oxalate or with silver malonate, thionyl chloride does react, but only decomposition products have been obtained.

The author proposes to apply this method to the preparation of anhydrides of hydroxy-acids and of optically active acids, and to the preparation of mixed anhydrides. Preliminary experiments indicate that this may be successfully done, and the author made this preliminary announcement in view of the fact that H. Meyer (*Chem. Zeit.*, 1909, **33**, 1036) outlines a method of preparing anhydrides of sulphonic acids from the corresponding alkali salts by the action of thionyl chloride.

283. "A new synthesis of oxazole derivatives."

By Robert Robinson.

The author has found that certain acyl derivatives of ω-aminoacetophenone are condensed, under the influence of sulphuric acid, to oxazoles.

ω-Benzoylaminoacetophenone, prepared by benzoylating ω-aminoacetophenone, crystallises in needles, melting at 123°, and when warmed with sulphuric acid furnishes 2 : 5-diphenyloxazole (E. Fischer, *Ber.*, 1896, **29**, 207). *ω-Phenylacetylaminoacetophenone* is obtained by the action of phenylacetyl chloride on ω-aminoacetophenone stannichloride in the presence of potassium hydroxide; it forms colourless needles or prisms melting at 104°. The *oxime* melts at 154°, and the *phenylhydrazone* at 184—185°.

When ω-phenylacetylaminoacetophenone is dissolved in sulphuric acid, it gives rise to 5-*phenyl*-2-*benzyloxazole*, crystallising in long, flat needles melting at 89°; the *picrate* melts at 103°. *α-Hydroxy-β-phenylacetylamino-α-phenylethane*, $OH{\cdot}CHPh{\cdot}CH_2{\cdot}NH{\cdot}CO{\cdot}CH_2Ph$, prepared by reducing ω-phenylacetylaminoacetophenone with sodium and dilute methyl alcohol, forms colourless prisms melting at 99°; it does not condense to an oxazole. On warming ω-benzoylaminoacetoveratrone with sulphuric acid, 2-*phenyl*-5-*veratryloxazole* is obtained in slender needles melting at 97°, and, in a similar manner, 2-*benzyl*-5-*veratryloxazole*, colourless needles, melting at 86°, is obtained from *ω-phenylacetylaminoacetoveratrone*, which melts at 135°, and is prepared from ω-aminoacetoveratrone stannichloride and phenylacetyl chloride. Reduction of 2-oximino-5 : 6-dimethoxy-1-hydrindone and benzoylation of the *hydrochloride* of the resulting 2-*amino*-compound furnishes 2-*benzoylamino*-5 : 6-*dimethoxy*-1-*hydrindone*, which crystallises in needles melting at 224°; the compound does not condense to an oxazole under the influence of sulphuric acid.

284. "Ethyl benzoylacetate."

By Edward Hope and William Henry Perkin, jun.

The authors have made a careful investigation of the conditions under which ethyl benzoylacetate is converted into mono- and di-substitution derivatives, and of the behaviour of these on hydrolysis.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Cook, *John.* Clavis Naturæ: or, the mystery of philosophy unvail'd. pp. xiv + 405. London 1733. From Mr. C. H. Cribb.

Iron and Steel Institute. Carnegie Scholarship Memoirs. Vol. I. pp. xii + 368. ill. London 1909. From the Institute.

II. *By Purchase.*

Laubenheimer, *Kurt.* Phenol und seine Derivate als Desinfektionsmittel. pp. vi + 156. Berlin 1909. (*Recd.* 24/11/09.)

Loeb, *Jacques.* Die chemische Entwicklungserregung des tierischen Eies. (Künstliche Parthenogenese.) pp. xxiv + 259. ill. Berlin 1909. (*Recd.* 24/11/09.)

Moser, *L.* Die Bestimmungsmethoden des Wismuts und seine Trennung von den anderen Elementen. (Die chemische Analyse, Vol. X.) Stuttgart 1909.

Newlands, *John A. R.*, and **Newlands,** *Benjamin E. R.* Sugar. A handbook for planters and refiners. pp. xxxvi + 876. ill. London 1909. (*Recd.* 10/11/09.)

Oppenheimer, *Carl.* Die Fermente und ihre Wirkungen. Spezieller Teil. 3rd edition. pp. xi + 491. Leipzig 1909. (*Recd.* 24/11/09.)

Ostwald, *Wolfgang.* Grundriss der Kolloidchemie. pp. xiv + 525. Dresden 1909. (*Recd.* 24/11/09.)

Starling, *Ernest H.* The Mercers' Company Lectures on the fluids of the body. pp. viii + 186. London 1909. (*Recd.* 27/11/09.)

Zerr, *George*, and **Rübencamp**, *R.* A treatise of colour manufacture. A guide to the preparation, examination, and application of all the pigment colours in practical use. Authorised English edition by *Charles* **Mayer**. pp. xiii + 605. ill. London 1908. (*Recd.* 27/11/09.)

III. *Pamphlets.*

Aschan, *Ossian.* Ueber die Konstitution des Isopinens. (From the *Öfversigt Finska Vetensk. Soc. Förhandl.*, 1908–1909, **51**, *A.*)

Barger, *George*, and **Dale**, *Henry Hallett.* The water-soluble active principles of ergot. (From the *J. Physiol.*, 1909, **38**.)

Barger, *George*, and **Walpole**, *George Stanley.* Isolation of the pressor principles of putrid meat. (From the *J. Physiol.*, 1909, **38**.)

Dale, *Henry Hallett.* Note on nutmeg-poisoning. (From the *Proc. Roy. Soc. Med.*, 1909.)

Dale, *Henry Hallett*, and **Dixon**, *Walter Ernest.* The action of pressor amines produced by putrefaction. (From the *J. Physiol.*, 1909, **39**.)

Goerner, *Paul.* Aromatische Nitroderivate insbesondere Nitrophenole als Alkaloidfaellungsmittel. pp. 45. Strassburg 1908.

Nebraska, University of. *Agricultural Experiment Station.* Twenty-second annual report. pp. 158. ill. Lincoln, Nebraska, 1909.

Neubauer, *Otto.* Ueber den Abbau der Aminosäuren in gesunden und kranken Organismus. (From the *Deut. Archiv. klin. Med.*, 1909, **95**.)

Palladino, *Pietro.* Du poids absolu des corps élémentaires et dépendance de leurs propriétés chimiques et physiques du poids absolu et de la forme. pp. 44. ill. Genova 1909.

Pfyl, *B.*, and **Rasenack**, *P.* Ueber die Verpuffungs und Verbrennungsprodukte von Zelluloid. (From the *Arbeiten K. Gesundheitsamte*, 1909, **32**.)

Rusconi, *Arnaldo.* Ricerca dell' alcool etilico nel cloroformio. (From the *Arch. Farmacol. sper. Sci. affini*, 1909, **8**.)

Zimmerman, *Joseph.* Ueber die Spaltung des Gypsophila-Saponins. pp. 58. Strassburg 1909.

JULIUS THOMSEN MEMORIAL LECTURE.

The Julius Thomsen Memorial Lecture will be delivered by Professor Sir Edward Thorpe, C.B., F.R.S., at the Ordinary Scientific Meeting on Thursday, February 17th, 1910, at 8.30 p.m.

At the next Ordinary Scientific Meeting on **Thursday,** December **16th,** 1909, at **8.30** p.m., the following papers will be communicated:

"The production of para-diazoimides from alkyl- and aryl-sulphonyl-para-diamines. A general reaction." By G. T. Morgan and J. A. Pickard.

"Organic derivatives of antimony. Part I. Tricamphorylstibine chloride and triphenylstibine hydroxynitrate and hydroxysulphate." By G. T. Morgan, Miss F. M. G. Micklethwait, and G. S. Whitby.

"The constituents of *Rumex ecklonianus.*" By F. Tutin and H. W. B. Clewer.

"The influence of non-electrolytes on the solubility of carbon dioxide in water." By F. L. Usher.

"Ethyl hydroxy*iso*butyrate." By W. Parry.

"The condensation of benzaldehyde with resorcinol." By F. G. Pope and H. Howard.

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[*Issued* 30/12/09

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 25. No. 364.

Thursday, December 16th, 1909, at 8.30 p.m., Professor HAROLD B. DIXON, F.R.S., President, in the Chair.

Referring to the loss sustained by the Society in the death of Dr. Ludwig Mond, the PRESIDENT stated that the Council had that afternoon passed the following resolution: "The Council of the Chemical Society desire to place on record their profound regret at the death of Dr. Ludwig Mond—a man distinguished no less for his lifelong researches in pure and applied Chemistry than for his wise beneficence for the advancement of Science. Dr. Mond was elected a Fellow of this Society in 1872, and served as a member of Council in 1885–6 and as Vice-President from 1887 to 1890, and again from 1894 to 1898. In the present year he was invited by the Council to accept nomination for the Presidency: unfortunately, ill-health prevented his acceptance. The industrial processes which Dr. Mond established and gradually perfected presented chemical and engineering problems only to be solved by a rare combination of scientific insight and of practical skill. The faith of Dr. Mond in well-guided research as the fertiliser at the root of a nation's industry was shown again and again when he applied his wealth to aid original investigation. Among his generous benefactions to the cause he had at heart, two stand out conspicuously—the fund which enabled the Royal Society to publish its catalogue of scientific papers, and the creation and endowment of the splendid Davy-Faraday Research Laboratory. To his adopted country Dr. Mond's work has been a help and an inspiration; we, his

Chemical colleagues, who know what that work was, desire to convey to his family our sense of the loss that science and the country have sustained."

It was further announced by the President that in view of the completion of fifty years' Fellowship by the Past Presidents the Rt. Hon. Sir Henry Roscoe, Sir William Crookes, Dr. Hugo Müller, and Dr. A. Vernon Harcourt, it has been resolved by the Council that the Society hold a dinner some time at the end of May or beginning of June, 1910, and that these gentlemen be entertained as guests of the Society.

Mr. Harold Baron was formally admitted a Fellow of the Society.

Certificates were read for the first time in favour of Messrs.:

Percival Frederick Adams, 81, Rock Avenue, Gillingham.
Alexander Charles Cumming, D.Sc., 39, Viewforth, Edinburgh.
Arthur Ernest Everest, B.Sc., Clifton House, Shrewsbury.
Aquila Forster, B.Sc., 156, Coatsworth Road, Gateshead-on-Tyne.
Charles Wright Meanwell, 15, Woodlands Crescent, Muswell Hill, N.

Certificates have been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Messrs.:

Tarak Nath Das, B.Sc., 31, Bhaironath, Benares City, India.
John William McBeath, West End, Kimberley, S. Africa.

Of the following papers, those marked * were read:

*285. "The production of para-diazoimides from alkyl- and aryl-sulphonyl-para-diamines. A general reaction." By Gilbert T. Morgan and Joseph Allen Pickard.

Earlier experiments having shown that many arylsulphonyl-*p*-diamines yield arylsulphonyl-*p*-diazoimides on treating their diazonium salts with aqueous sodium acetate, a further selection of these acylated diamines containing very dissimilar alkyl- and aryl-sulphonyl groups has been examined, with the result that this condensation has been found to be a general one.

Benzene-1 : 3 : 5-*trisulphonyltri*-p-*phenylenediamine*,

$$C_6H_3(SO_2{\cdot}NH{\cdot}C_6H_4{\cdot}NH_2)_3,$$

was taken as a typical example of a *p*-aminophenylamide derived from an aromatic polysulphonic acid. When successively diazotised and treated with aqueous sodium acetate, it gives rise to the complex *p*-diazoimide, *benzene*-1 : 3 : 5-*trisulphonyltri*-p-*phenylenediazoimide*,

$$C_6H_3(SO_2{\cdot}\underline{N{\cdot}C_6H_4{\cdot}N_2})_3.$$

As a type of a diamine containing a mixed aromatic alkylsulphonyl group, *toluene-ω-sulphonyl*-p-*phenylenediamine*,

$$C_6H_5{\cdot}CH_2{\cdot}SO_2{\cdot}NH{\cdot}C_6H_4{\cdot}NH_2,$$

was prepared; it readily yields *toluene-ω-sulphonyl*-p-*phenylenediazoimide*, $C_6H_5{\cdot}CH_2{\cdot}SO_2{\cdot}N{\cdot}C_6H_4{\cdot}N_2$.

The general character of this condensation was finally demonstrated by preparing the two simplest members of the series of alkylsulphonyl-*p*-diazoimides, namely, *methanesulphonyl*-p-*phenylenediazoimide*,

$$CH_3{\cdot}SO_2{\cdot}N{\cdot}C_6H_4{\cdot}N_2,$$

and *methanedisulphonylbis*-p-*phenylenediazoimide*,

$$CH_2(SO_2{\cdot}N{\cdot}C_6H_4{\cdot}N_2)_2,$$

obtained respectively from *methanesulphonyl*-p-*phenylenediamine*,

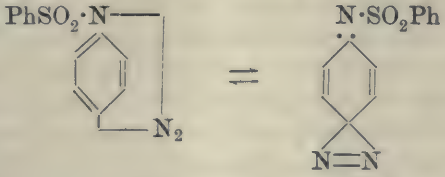
$$CH_3{\cdot}SO_2{\cdot}NH{\cdot}C_6H_4{\cdot}NH_2,$$

and *methanedisulphonylbis*-p-*phenylenediamine*,

$$CH_2(SO_2{\cdot}NH{\cdot}C_6H_4{\cdot}NH_2)_2.$$

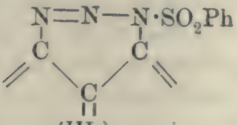
DISCUSSION.

Dr. **MORGAN**, in reference to Prof. Armstrong's expression of opinion that the para-diazoimides were equilibrated mixtures, said that he should be inclined to regard this series, and also the closely allied para-diazo-oxides, as having alternately para-cyclic and para-quinonoid structures:



(I). (II.)

were it not for the fact that these compounds closely resemble in physical and chemical properties the naphthylene-1:8-diazoimides (III) and 1:8-diazo-oxides (IV) respectively. In the absence of evidence concerning the properties of peri-(1:8)-naphthaquinone or its derivatives, it seems preferable to regard these 1:8-naphthylene-diazoimides and diazo-oxides as being cyclic compounds with 6-membered rings (III and IV), and thence by analogy to accept formula (I) as representing the structure of the para-diazoimides.



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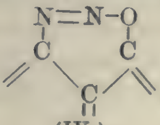


(IV.)

In answer to Dr. Hewitt's question as to the constitution of non-aromatic diazonium salts, he was of opinion that so long as one of the three phases of the diazonium oscillation could be formulated, the existence of the diazonium salt was possible, although such a compound with only one phase would be less stable than the aromatic diazonium salt with three phases. The dynamic hypothesis of the constitution of diazonium salts would be overthrown by the diazotisation of an amino-derivative of a fully saturated organic complex, but this result had never yet been realised experimentally.

*286. "Organic derivatives of antimony. Part I. Tricamphorylstibine chloride and triphenylstibine hydroxynitrate and hydroxysulphate." By Gilbert T. Morgan, Frances M. G. Micklethwait, and George Stafford Whitby.

Comparative experiments on the interaction of sodium camphor and the trichlorides of phosphorus, arsenic, and antimony have shown that, in the last case, the principal product is *tricamphorylstibine chloride*, $(C_{10}H_{15}O)_3SbCl_2$, a substance which, although stable in the presence of mineral acids, is readily hydrolysed by aqueous alkalis, and even by moist silver oxide, into hydrochloric and antimonic acids and camphor. This product is, therefore, much less stable than triphenylstibine chloride, which under similar conditions yields triphenylantimonic oxide.

When triphenylstibine chloride is warmed with alcoholic silver nitrate, it loses both its chlorine atoms, and gives rise to triphenylstibine nitrate, which is partly hydrolysed by hot water to *triphenylstibine hydroxynitrate*, $(C_6H_5)_3Sb(OH)\cdot NO_3$, this product crystallising unchanged from boiling aqueous solutions and also from benzene.

Triphenylstibine hydroxysulphate, $(C_6H_5)_3Sb(OH)\cdot SO_4\cdot Sb(C_6H_5)_3\cdot OH$, is similarly obtained by adding triphenylstibine chloride dissolved in alcohol to a hot aqueous solution of silver sulphate.

*287. "The constituents of Rumex Ecklonianus." By Frank Tutin and Hubert William Bentley Clewer.

Rumex Ecklonianus, Meisner, is an herb indigenous to South Africa, where it is reputed to possess medicinal properties. An alcoholic extract of this plant yielded, together with resinous products and a small amount of essential oil, the following compounds: Ceryl alcohol; a phytosterol, $C_{20}H_{34}O$, apparently identical with rhamnol; palmitic, stearic, oleic, linolic, and *iso*linolenic acids; a small amount of ipuranol, $C_{23}H_{38}O_2(OH)_2$; kaempferol; chrysophanic acid; emodin;

and emodin monomethyl ether; together with traces of other crystalline substances and large amounts of inorganic salts. A sugar which yielded *d*-phenylglucosazone was also present in small amount, but no evidence could be obtained of the presence of a glucoside. The emodin monomethyl ether which was isolated was identical with that obtained by Perkin and Hummel from *Ventilago madraspatana* (*Trans.*, 1894, **65**, 932), and with that prepared synthetically by Jowett and Potter (*Trans.*, 1903, **77**, 1330). The *dimethyl ether* of *chrysophanic acid* was prepared, and obtained in yellow prisms, melting at 190°.

*288. "The influence of non-electrolytes on the solubility of carbon dioxide in water." By Francis Lawry Usher.

The solubility of carbon dioxide in solutions of the following substances was measured at 20°: sucrose, mannite, dextrose, glycine, pyrogallol, thiocarbamide, antipyrine, carbamide, acetic acid, catechol, urethane, *n*-propyl alcohol, acetamide, quinol, and resorcinol. The solutions were all $N/2$, with the exception of sucrose, which was examined at four different concentrations. It was found that the change in the solubility of carbon dioxide produced is a linear function of the quantity of sucrose present, for solutions more dilute than $N/2$, on the volume-normal basis of calculation. Of the fifteen substances enumerated above, the first twelve depress the solubility of carbon dioxide, the magnitude of the effect decreasing in the order given, from 26 per cent. in the case of sucrose to 1 per cent. in that of *n*-propyl alcohol. Acetamide, quinol, and resorcinol produce a slight elevation of solubility.

The results were discussed from the standpoint of the theory recently advanced by Philip (*Trans.*, 1907, **91**, 711), which is found to be inadequate to account for the majority of the observations. Jahn's formula, $C_1/C_2=1$, was also shown to be inapplicable to the data hitherto available.

It is suggested, in common with Rothmund and others, that the phenomena observed can at present only be referred to mutual interaction of the molecules.

Discussion.

Dr. Philip said that when he presented to the Society his communication dealing with this matter, he had expressed the view that too little attention had been paid to the influence of non-electrolytes on the solubility of gases. Experiments were now in progress bearing on this point.

One important piece of evidence in favour of the hydration theory with which the author had not dealt was the fact that in the great majority of cases $\frac{\alpha - \alpha'}{N}$ increases with dilution, α and α' being the absorption coefficients of the gas in water and solution respectively, and N being the number of gram-equivalents of the dissolved substance per litre. This fact showed that the cause responsible for the lowering of the solubility of a gas was most potent in dilute solution.

The assumption made in his (Dr. Philip's) paper (*loc. cit.*), that the dissolved substance takes no part in the absorption of gas, should not be indefinitely extended. Obviously, there were many cases, for instance, the aqueous solution of acetic acid used by Mr. Usher, in which the dissolved substance had considerable solvent power for the gas.

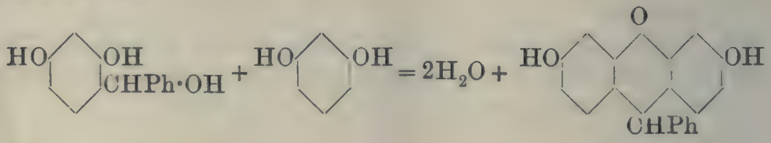
Mr. Usher replied that, as was expected, the equivalent depression of solubility was found to increase with dilution.

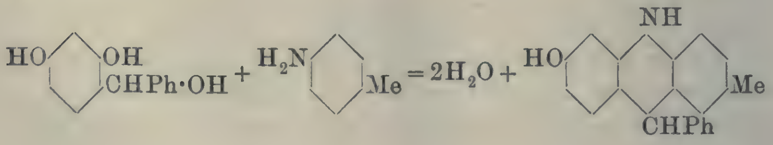
The strongest argument against any explanation depending on the assumption that neither the dissolved substance nor the water which might be combined with it had no solvent action was, in his opinion, the observation that, with the majority of the substances examined, the solubility of carbon dioxide in the water of the solutions was in excess of its normal solubility in pure water.

*289. "The condensation of benzaldehyde with resorcinol."

By Frank George Pope and Hubert Howard.

Benzaldehyde and resorcinol in the presence of aqueous solutions of the alkali hydroxides condense to form 2 : 4-dihydroxybenzhydrol. The latter compound also condenses with phenols and with amines in the presence of zinc chloride to yield substituted xanthenes and hydroacridines, thus :





290. "Ethyl α-hydroxy*iso*butyrate." By William Parry.

Ethyl α-hydroxy*iso*butyrate may be conveniently prepared from pure acetone by converting the latter into its cyanohydrin, hydrolysing this, and isolating the resulting acid in the form of its zinc salt.

Anhydrous zinc α-hydroxy*iso*butyrate (100 grams) is then mixed with alcohol (200 c.c.) and sulphuric acid (35 c.c.), and heated on the water-bath for eight hours. After addition of water and extraction with ether, the solution is washed, dried, and the ether distilled. Fractionation of the residual liquid gives ethyl α-hydroxy*iso*butyrate, boiling at 145—150°. After distillation over phosphoric oxide, it boils at 148—150°, and the yield is about half the weight of acetone employed.

The author is studying the action of Grignard's reagents on this ester and on others of similar type.

291. "The action of hydrogen dioxide on thiocarbamides." By Edward de Barry Barnett.

The action of hydrogen dioxide on thiocarbamide and some of its derivatives in neutral and alkaline solution has been studied, and evidence was brought forward to show that under these conditions sulphinic acids are formed.

292. "Chlorination and bromination of acylanilides. Part II. The action of the halogen acids on chloro- and bromo-acylaminobenzenes." (Preliminary note.) By Kennedy Joseph Previté Orton and William Jacob Jones.

In glacial acetic acid solution, hydrobromic acid and acylchloroaminobenzenes and hydrochloric acid and acylbromoaminobenzenes react quantitatively, yielding identical solutions: $Ar{\cdot}NClAc + HBr = Ar{\cdot}NHAc + BrCl$ and $Ar{\cdot}NBrAc + HCl = Ar{\cdot}NHAc + BrCl$ (*Brit. Assoc. Reports*, Winnipeg, 1909). These solutions have been shown tintometrically and by aspiration (compare Orton and Jones, *Trans.*, 1909, **95**, 1456) to contain bromine chloride, which has been found to exist nearly free from bromine and chlorine in this and other anhydrous solvents at 16°. In mixtures prepared by each of these ways, or from the anilide and bromine chloride, a rapid bromination of the anilide occurs, the speed of the reactions being the same in each case. In dilute acetic acids analogous reactions take place, but now differences appear, and complications are caused by the hydrolysis of the bromine chloride.

Hydrobromic acid and an acylbromoamine react thus: Ar·NBrAc + HBr = Ar·NHAc + Br_2. The interaction has been shown by a tintometric method to be quantitative for glacial and dilute acetic acids. The mixtures are identical (except for the presence of hydrochloric acid) with those prepared from equivalent quantities of the corresponding chloroamine and two equivalents of hydrobromic acid: Ar·NClAc + 2HBr = Ar·NHAc + Br_2 + HCl. Moreover, the speed of bromination in these two mixtures is the same, and also equal to the speed of bromination in the system prepared from anilide and bromine. The velocity of bromination is now, however, very much smaller than in the systems above described, where bromine chloride is present.

If an equilibrium exists between hydrobromic acid, the bromoamine, anilide and bromine in acetic acid solution analogous to that found by the authors (*loc. cit.*) to exist between the chloroamine and hydrochloric acid, the bromoamine and hydrobromic acid are at very small concentration. In such solvents as chloroform and carbon tetrachloride, chloroamines and bromoamines cannot be shown to exist in detectable quantities in the presence of hydrogen chloride and bromide.

The interaction of hydriodic acid and chloroamines in acetic acid solution has been investigated by a tintometric comparison with standard solutions of iodine chloride and iodine. When one molecular proportion of hydriodic acid is used, the reaction is quantitatively Ar·NClAc + HI = ICl + Ar·NHAc; and with two molecular proportions of hydriodic acid: Ar·NClAc + 2HI = Ar·NHAc + I_2 + HCl. Although in aqueous solution, iodine chloride is hydrolysed, the resulting hypoiodous acid then rapidly decomposing in the usual way, it possesses, even in 25 per cent. acetic acid, considerable stability.

These results are in accord with the view suggested recently as to the process of conversion of chloro- or bromo-amines into the isomeric chloro- or bromo-acylanilides (Orton and Jones, this vol., p. 233), namely, that primarily the former react with the halogen acids to form anilide and halogen, which can then interact, producing the *C*-halogen derivative.

293. "A contribution to the study of the oxydases."

By Ross Aiken Gortner.

The author has obtained a new variety of the tyrosine oxidising ferment, tyrosinase, obtained from the larva of *Tenebro molitor*. This variety is distinguished from the known tyrosinases by its insolubility in water, by its loss of vitality when treated with glycerol, or when subjected to drying, and by its inability to oxidise resorcinol, orcinol, quinol, or pyramidone.

A chromogen has been isolated from the body contents of the larva of *Tenebro molitor*, which gives with tyrosinase, colour reactions identical with those given by tyrosine.

Tyrosinase has also been identified in two examples of myripods, *Scalopocryptops sexpinosa* and *Julius canadensis* (Newp.), in the larva of *Cucujus clavipes*, in the colourless plant, *Monotropa uniflora*, and an observation has been made that extracts of almost all animal tissues possess the power of oxidising quinol.

294. "Experiments on substituted allenecarboxylic acids. Part I."

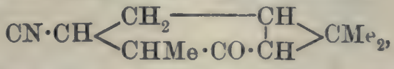
By Arthur Lapworth and Elkan Wechsler.

The authors have synthesised *αγ-diphenyl-γ-*1*-naphthylallene-α-carboxylic acid*, $C_{10}H_7\cdot CPh\colon C\colon CPh\cdot CO_2H$. It gives a very stable, crystalline compound with ether, but its salts with active bases do not crystallise. The authors have not been successful in resolving the substance into its optically active constituents by any of the ordinary methods.

295. "Cyanocarone."

By Reginald William Lane Clarke and Arthur Lapworth.

The preparation and properties of *cyanocarone*,



$$CN\cdot CH\Big\langle\begin{array}{l} CH_2\text{———}CH \\ CHMe\cdot CO\cdot CH \end{array}\Big\rangle CMe_2,$$

and some of its derivatives were described. The cyano-ketone very readily gives up the elements of hydrogen cyanide, and is then at once converted into eucarvone. This confirms the usual view of the mechanism of the conversion of carvone into eucarvone, and indicates that the relative stabilities of carbon rings of different sizes may be inverted when a double linking is introduced.

296. "The influence of water on the availability of hydrogen chloride in alcoholic solution." By Arthur Lapworth and James Riddick Partington.

The influence of water on the availability of very dilute solutions of hydrogen chloride in absolute alcohol has been carefully examined. Several tintometric experiments were made with five different specimens of alcohol dried over excess of calcium, two different indicators being employed in all cases but one, involving a large variation in the total concentration of the hydrogen chloride used. In each case, too, the change in the velocity of esterification of phenylacetic acid by the alcoholic hydrogen chloride, brought about by the addition of water, was estimated. The results prove that within the limits of experimental error, the availability of hydrogen chloride in very dilute alcoholic solution is proportional to concentration of HCl/r + concentration of water, r being identical with the constant used by Goldschmidt and Udby, and termed by them the "hydrolytic constant" of ethyl alcohol hydrochloride, but which the present authors prefer to call the "water-value" of the alcohol. The value of r found was nearly 0·10 at 25° in all cases (that is, 1 litre of alcohol at 25° is equivalent to 0·10 gram-molecule of water), the discrepancy between this and the number 0·15 adopted by Goldschmidt and Udby being apparently due, in the main, to the fact that in the former instance the hydrogen chloride was highly dilute and more fully ionised.

The velocity of esterification of a carboxylic acid in a large quantity of alcohol containing varying small quantities of water is proportional to *concentration of carboxylic acid* × *availability of the catalyst*, and the curve only departs from the unimolecular type in so far as the water formed disturbs the availability of the catalyst.

As the availability of an acid varies enormously with the solvent, even where its concentration and degree of dissociation are similar, the determination of the exact value of this quantity is of primary importance in all investigations connected with salt formation and catalysis in which acids take part.

297. "Amides and imides of camphoric acid." (Preliminary note.)

By William Ord Wootton.

In view of the recent publication of a paper by Abati and Notaris (*Gazzetta*, 1909, **39**, ii, 219), the author stated that he had been engaged for some time past in the examination of a number of derivatives of α-camphoramic acid of the type $CO_2H{\cdot}C_8H_{14}{\cdot}CO{\cdot}NHR$, together with the corresponding imides. Amongst the substances prepared are the acids and imides arising from the condensation of camphoric anhydride with ethylamine, *n*-propylamine, *n*-butylamine, *n*-amylamine, *n*-hexylamine, allylamine, *o*-, *m*-, and *p*-toluidine, *o*-, *m*-, and *p*-chloroaniline, *o*- and *m*-bromoaniline, *m*-nitroaniline, *p*-aminophenol, *p*-phenetidine, α- and β-naphthylamine.

In the majority of cases the conversion of the acid into the imide, a process involving ring-formation, is marked by considerable diminution in the specific rotation of the compound.

298. "The nomenclature of imino-compounds and of those compounds exhibiting imino-amino-isomerism." By Jocelyn Field Thorpe.

Some confusion exists owing to the present system of nomenclature adopted for the imino-compounds.

These substances, which possess the group $\mathrm{C{:}NH}$, are obviously just as different from the secondary amines having the group $\begin{matrix}\mathrm{C}\\\mathrm{C}\end{matrix}\!\!>\mathrm{NH}$ as the ketones with the group $\mathrm{C{:}O}$ are different from the ethers with the group $\begin{matrix}\mathrm{C}\\\mathrm{C}\end{matrix}\!\!>\mathrm{O}$, yet the general name of imine is applied to both these classes.

It is suggested that as the compounds containing the group $\mathrm{C{:}NH}$ are in many respects analogous to the ketones, the general name *ketimine* should be applied to them, leaving the name imine to be applied to the secondary amines, thus:

$\mathrm{C{:}O}$	$\mathrm{C{:}NH}$	$\begin{matrix}\mathrm{C}\\\mathrm{C}\end{matrix}\!\!>\mathrm{NH}$
Ketone.	Ketimine.	Imine.

Moreover, the well-established existence of tautomerism and desmotropism between compounds of the type:

$$\mathrm{CH{\cdot}C({:}NH){\cdot}C} \quad \text{and} \quad \mathrm{C{:}C(NH_2){\cdot}C}$$

renders it advisable to apply some general term to this form of isomerism, similar to the phrase *keto-enolic* isomerism in use with the oxygen derivatives.

It is proposed that the name *ketimine-enamic* isomerism should be applied to this phenomenon.

It is not proposed to alter the name of the *enamic* individual, since such substances can evidently be classified as amino-compounds without entailing any confusion.

Thus, in a compound showing *ketimine-enamic* isomerism, the two forms would be:

$\mathrm{CH_3{\cdot}C({:}NH){\cdot}CH(CN){\cdot}CO_2Et}$	$\mathrm{CH_3{\cdot}C(NH_2){:}C(CN){\cdot}CO_2Et}$
Ethyl β-ketimino-α-cyanobutyrate (*ketimine* form).	Ethyl β-amino-α-cyanocrotonate (ename form).

corresponding with

$\mathrm{CH_3{\cdot}CO{\cdot}CH(CN){\cdot}CO_2Et}$	$\mathrm{CH_3{\cdot}C(OH){:}C(CN){\cdot}CO_2Et}$
Ethyl β-keto-α-cyanobutyrate (keto-form).	Ethyl β-hydroxy-α-cyanocrotonate (enol form).

This nomenclature would be applicable to a number of other classes of compounds in which tautomerism of this kind has been shown to exist, such as the acid amides, the complex ureides, etc.

299. "Dicamphorylphosphinic acid." By Gilbert T. Morgan and W. R. Moore.

Dicamphorylphosphinic acid, $(C_{10}H_{15}O)_2PO\cdot OH$, has been obtained by condensing sodium camphor and phosphorus trichloride, and extracting the product with aqueous alkali hydroxides. The study of this compound is in progress.

300. "The combustion of naphthalene and other organic substances, and the atomic weight of carbon." By Alexander Scott.

Although Dumas and Stas (*Ann. Chim. Phys.*, 1841, [iii], **1**, 40) used the combustion of naphthalene, cinnamic and benzoic acids, and some other organic substances to justify their new value of C = 12·00 in preference to that of 12·24, advocated by Berzelius, neither they nor anyone else seem to have recognised or utilised the advantages of such a substance as naphthalene for affording data for an accurate determination of the atomic weight of carbon.

The experiments of Dixon, Baker, and others suggest that it is more than likely that the combustion of pure *dry* carbon in *dry* oxygen might lead to carbon monoxide escaping even with a large excess of oxygen. The combustion of a hydrocarbon would lessen any loss from such a cause enormously, as some trace at least of water may be assumed to be present throughout the combustion. Each gram of naphthalene burnt ought to give 3·4359 grams of carbon dioxide if C = 12·000 and H = 1·0075, but if C = 12·018 only 3·4325 ought to be produced, hence for a difference of 0·018 in the atomic weight of carbon we get a difference of 3·4 milligrams in the carbon dioxide produced.

Two series of combustions have been carried out with naphthalene, one set in a glass tube and the other in a quartz tube, both in a current of oxygen. In all, six experiments were made, and 17·6175 grams of naphthalene gave 60·5355 grams of carbon dioxide, hence 1 gram of naphthalene gave 3·4361 grams of carbon dioxide, whence C = 11·999.

Similarly, with cinnamic acid each gram ought to yield 2·67459 grams of carbon dioxide if C = 12·000, but only 2·67276 if C = 12·018. Two experiments have been made, giving together 8·61537 grams of cinnamic acid, which yielded 23·0413 grams of carbon dioxide, that is, 1 gram of cinnamic acid yielded 2·67444 grams of carbon dioxide, whence C = 12·0015.

These results therefore agree with all other combustion and physical results in indicating that C = 12·00. The cause of the discrepancy between these results and those derived from the alkylammonium bromides remains still to be discovered.

It might be thought that the enormous number of combustions of organic compounds which are continually being made would have indicated whether C = 12·000 or C = 12·018 were the correct number. This is hardly likely, however, for if we calculate the percentage of carbon in naphthalene, taking C = 12·00 and C = 12·018, this comes out 93·706 and 93·715 respectively, and both would be stated as 93·71 per cent. within the limits of experimental error.

The weights given above are all corrected to vacuum standard.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Allen, *Alfred Henry.* Commercial organic analysis. A treatise on the properties, modes of assaying, and proximate analytical examination of the various organic chemicals and products employed in the arts, manufactures, medicine, etc. With concise methods for the detection and estimation of their impurities, adulterations, and products of decomposition. 4th edition. Edited by *Henry* **Leffmann** and *W. A.* **Davis.** Vol. I. pp. x + 576. ill. London 1909. (*Recd.* 9/12/09.) From the Publishers: Messrs. J. & A. Churchill.

Crookes, *Sir William.* Diamonds. pp. xvi + 146. ill. London 1909. (*Recd.* 13/12/09.)
From the Publishers: Messrs. Harper & Brothers.

Eijkman, *J. F.* Tafeln zum gebrauche bei der Bestimmung von Brechungsindices nach der Methode der konstanten Deviation von 40°. pp. [102]. Groningen 1909. (*Recd.* 10/12/09.)
From the Author.

Gemmell, *George Harrison.* Chemical notes and equations, inorganic and organic. 2nd edition. pp. xiii + 265. London 1909. (*Recd.* 10/12/09.)
From the Publishers: Messrs. Baillière, Tindall, and Cox.

Morgan, *J. Livingston R.* Physical chemistry for electrical engineers. 2nd edition. pp. x + 249. New York 1909. (*Recd.* 10/12/09.) From the Publishers: Messrs. John Wiley & Sons.

Thorpe, *Sir Edward.* History of chemistry. Vol. I. From the earliest times to the middle of the nineteenth century. pp. viii + 148. ill. London 1909. (*Recd.* 10/12/09.)
From the Publishers: Messrs. Watts & Co.

Van Nostrand's Chemical annual, 1909. A hand-book of useful data. Edited by *John C.* **Olsen.** pp. xii + 580. London 1909. (*Recd.* 10/12/09.)

From the Publishers: Messrs. Constable and Company.

II. *By Purchase.*

König, *Franz Josef.* Chemie der menschlichen Nahrungs- und Genussmittel. 4th edition. Vol. III. Untersuchung von Nahrungs-, Genussmitteln und Gebrauchsgegenständen. Teil I. Allgemeine Untersuchungsverfahren. pp. xiv + 772. ill. Berlin [1909]. (*Recd.* 7/12/09.)

Lunge, *George.* The manufacture of sulphuric acid and alkali, with the collateral branches. 3rd edition. Vol. II. Sulphate of soda, hydrochloric acid, Leblanc soda. 2 vols. pp. xx + 490, xii + 493 to 1010. ill. London 1909. (*Recd.* 4/12/09.)

JULIUS THOMSEN MEMORIAL LECTURE.

The Julius Thomsen Memorial Lecture will be delivered by Professor Sir Edward Thorpe, C.B., F.R.S., at the Ordinary Scientific Meeting on Thursday, February 17th, 1910, at 8.30 p.m.

PRESENTATION TO PROFESSOR KOERNER.

A Committee has been formed in Milan with the object of celebrating the seventieth birthday of Professor Koerner. It is proposed to devote subscriptions to the following purposes:

1. Foundation of a prize for work in pure and applied chemistry.
2. Reprinting Professor Koerner's works.
3. Presentation of a gold medal to Professor Koerner.

The Treasurer of the Chemical Society will be glad to receive subscriptions, and will forward them to the Organising Committee.

TABLES OF INTERNATIONAL ATOMIC WEIGHTS, 1910.

To encourage the use by Students of the Tables of Atomic Weights, as issued by the International Committee, the Council has decided to offer the Tables at the following prices:

On **Cards**: 1/- per doz.; 4/- per 50; 7/6 per 100.
On **Paper**: 4*d*. per doz.; 1/- per 50; 1/9 per 100.

(Note: The Tables printed on paper are suitable for pasting into note-books.)

At the next Ordinary Scientific Meeting on **Thursday**, January **20th**, 1910, at **8.30** p.m., the following papers will be communicated:

"The alkaloids of ergot. Part II." By G. Barger and A. J. Ewins.

"The constituents of colocynth." By F. B. Power and C. W. Moore.

"The triazo-group. Part XI. Substituted triazomalonic and phenyltriazoacetic acids." By M. O. Forster and R. Müller.

"Iodobenzenemonosulphonic acids. Part II. Esters and salts of di- and tri-iodobenzenesulphonic acids." By Miss M. Boyle.

"Organic derivatives of silicon. Part XII. Dibenzylethylpropylsilicane and sulphonic acids derived from it." By F. Challenger and F. S. Kipping.

"The absorption spectra of naphthalene and of tetramethylnaphthalene." By Miss A. Homer and J. E. Purvis.

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OF THE

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CORRECTED TO AUGUST, 1909.

BURLINGTON HOUSE,
LONDON, W.
1909.

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ELECTED MARCH 25th., 1909.

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Professor Harold B. Dixon (President), Dr. A. Scott (Treasurer), Dr. M. O. Forster and Prof. A. W. Crossley (Hon. Secretaries), and Dr. Horace T. Brown (Foreign Secretary), are *ex officio* members of each Committee.

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The Ordinary Scientific Meetings for 1909-10 will be held on the following Thursdays at 8.30 p.m. :—

October 21st, 1909
November 4th, ,,
,, 18th,* ,,
December 2nd, ,,
,, 16th,* ,,
January 20th,* 1910
February 3rd, ,,
,, 17th,* ,,

March 3rd, 1910
,, 17th,* ,,
April 21st,* ,,
May 5th, ,
,, 19th,* ,,
June 2nd, ,,
,, 16th,* ,,

*Council Meetings will be held on these days.

Annual General Meeting, Friday, March 18th, 1910, at 5 p.m.

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ARTHUR AIKIN (*d. 1854*)	1843–1845
WILLIAM THOMAS BRANDE, F.R.S. (*d. 1866*)	1847–1849
RICHARD PHILLIPS, F.R.S. (*d. 1851*)	1849–1851
CHARLES GILES BRIDLE DAUBENY, M.D., F.R.S. (*d. 1867*)	1851–1853
PHILIP JAMES YORKE, F.R.S. (*d. 1874*)	1853–1855
WILLIAM ALLEN MILLER, M.D., D.C.L., F.R.S. (*d. 1870*)	1855–1857 1865–1867
LORD PLAYFAIR, F.R.S. (*d. 1898*)	1857–1859
Sir BENJAMIN COLLINS BRODIE, Bart., D.C.L., F.R.S. (*d. 1880*)	1859–1861
AUGUST WILHELM VON HOFMANN, Ph.D., LL.D., F.R.S. (*d. 1892*)	1861–1863
ALEXANDER WILLIAM WILLIAMSON, Ph.D., F.R.S. (*d.* 1904)	1863–1865 1869–1871
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WILLIAM ODLING, M.A., M.B., F.R.S.	1873–1875
Sir FREDERICK AUGUSTUS ABEL, Bart., K.C.B., G.C.V.O., F.R.S. (*d. 1902*)	1875–1877
JOHN HALL GLADSTONE, Ph.D., F.R.S. (*d. 1902*)	1877–1879
Sir HENRY ENFIELD ROSCOE, D.C.L., LL.D., F.R.S.	1880–1882
Sir JOSEPH HENRY GILBERT, Ph.D., F.R.S. (*d. 1901*)	1882–1883
Sir WILLIAM HENRY PERKIN, LL.D., F.R.S. (*d. 1907*)	1883–1885
HUGO MÜLLER, Ph.D., LL.D., F.R.S.	1885–1887
Sir WILLIAM CROOKES, D.Sc., F.R.S.	1887–1889
WILLIAM JAMES RUSSELL, Ph.D., F.R.S.	1889–1891
ALEXANDER CRUM BROWN, M.D., D.Sc., F.R.S.	1891–1893
HENRY EDWARD ARMSTRONG, Ph.D., LL.D., F.R.S.	1893–1895
AUGUSTUS GEORGE VERNON HARCOURT, M.A., D.Sc., F.R.S.	1895–1897
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Sir WILLIAM RAMSAY, K.C.B., D.Sc., F.R.S.	1907–1909

THE CHEMICAL SOCIETY.

The Chemical Society was founded on February 23rd, 1841, and its first General Meeting was held on March 30th of that year. In 1848, a Charter of Incorporation was granted to the Society by the Crown, under the conditions of which it consists of Fellows, Honorary and Foreign Members, and Associates.* The Fellows elect out of their own body a Council consisting of a President, Vice-Presidents, a Treasurer, two Secretaries, a Foreign Secretary, and twelve other Fellows, by whom the business of the Society is conducted.

The object of the Society, as laid down in the Charter, is the general advancement of Chemical Science, by the discussion and publication of new discoveries, and the interchange of valuable information respecting them.

A Candidate for election as a Fellow of the Chemical Society must send to the Secretaries a Certificate subscribed by not less than five Fellows of the Society, to three at least of whom he must be personally known.† The Certificate will be read at three Ordinary Meetings of the Society, and the Candidate will afterwards be balloted for. When elected, he will receive notice thereof from the Secretaries.

Each Fellow has the right to be present and to vote at all Meetings of the Society, and to propose Candidates for admission into the Society, and is entitled to one copy of the Annual Publications so long as his Annual Subscription be not in arrear. He is also entitled to the use of the books in the Society's Library, under such restrictions as the Council may deem necessary. He has the privilege of introducing to Ordinary Scientific Meetings of the Society, two visitors, whose names are entered in a book kept for that purpose, together with the name of the Fellow introducing such visitors.

When elected, every Candidate previous to admission is required, within three months from the date of his election, to pay an admission fee of £4, and either his first annual subscription, or his life composition fee; otherwise his election becomes void. The annual subscription to be paid by Fellows is £2. The subscriptions of Fellows become due on the first day of January of every year. The life composition fee is £30, excepting that Fellows who have paid ten annual subscriptions pay as life composition fee £20; Fellows who have paid fifteen annual subscriptions pay £15; Fellows who have paid twenty annual subscriptions pay £12; and Fellows who have paid twenty-five annual subscriptions pay £10.

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* No elections of Associates have taken place for many years.

† In the case of Candidates resident abroad unable to obtain this number of signatures, the Council have power to accept a certificate signed from personal knowledge by one Fellow of the Society, and to recommend its presentation for ballot.

If a Candidate be elected during the month of November or December, he will not be called upon to pay any annual subscription for the current year, and will not be entitled to receive the publications of the Society for that year.

Any Fellow who at the period of the Annual General Meeting of the Society in March owes two annual subscriptions, such subscriptions having been duly applied for, and no reason satisfactory to the President and Council having been assigned for their non-payment, shall cease to be a Fellow of the Society, and his name will be removed from the Society's List accordingly: Provided, nevertheless, that on a solicitation for re-admission being addressed to the President and Council by a person so circumstanced, the case of such person will be considered by the Council, who may, if they see fit, reinstate him as a Fellow of the Society, upon his paying the arrears of his subscription, or a life composition fee.

COMMUNICATION OF PAPERS.

All communications for the Journal and for the Proceedings of the Society should be addressed to "The Secretaries, Chemical Society, Burlington House, W."

The Council have decided that no communication shall be included in the list of titles of papers to be brought before a Meeting of the Society, unless it is in the hands of the Secretaries at least three days before the date of the Meeting. No announcement of titles can be made in the Proceedings until the communications have been received by the Secretaries. Papers which, on the report of referees, are deemed by the Council unsuitable for publication in the Transactions, are deposited in the Society's Archives. Authors are advised, therefore, to retain copies of their papers.

In all cases, an abstract of the paper, not exceeding three hundred words in length, should be supplied for insertion in the Proceedings.

Communications are put down on the list for reading in the order in which they are received.

Communications which have already appeared in any foreign journal will not be published in the Society's Transactions, unless this course is specially recommended by the Publication Committee and this recommendation approved by the Council.

PUBLICATIONS OF THE SOCIETY.

With the exception of certain numbers of the Journals and Proceedings which are out of print, the following publications may be obtained from Messrs. Gurney and Jackson, 10, Paternoster Row, E.C. :

		Price to Fellows.			Price to Public.		
		£	s.	d.	£	s.	d.
Memoirs and Proceedings, 1841-1847 (3 Vols.) ...	per vol.	1	0	0	1	10	0
Quarterly Journal, 1848-1862 (14 Vols.)...	per vol.	1	0	0	1	10	0
,, ,, ,, ,, (Single Parts)	per part		5	0		7	6
Journal, 1862–1895	per vol.	1	10	0	1	10	0
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,, 1896 to present date	per vol.	2	0	0	2	0	0
,, ,, ,, (Single Parts)	per part		3	6		3	6
Proceedings, 1885 to present date	per vol.		7	6		7	6
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* ,, ,, ,, IV. 1893–1902	per vol.	1	0	0	1	10	0
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Tables of International Atomic Weights (as recommended by the International Atomic Weights Committee). 1/6 per doz. ; 12/- per hundred.

* Postage to Fellows One Shilling extra.
† Post free to Fellows.

The *Journal*, which is published on the last day of each month, includes the Transactions of the Chemical Society and Abstracts of chemical papers published in other Journals.

The *Proceedings* contain certain papers read at the meetings and abstracts of the remainder and of the discussions. They are, as a rule, issued to the Fellows about a week after each Ordinary Scientific Meeting.

The Annual Reports on the Progress of Chemistry contain an epitome of the principal definite steps in advance which have been made during the year. Fellows can obtain, from the Assistant Secretary, cases for binding the Annual Reports, price One Shilling each.

RESEARCH FUND.

The Research Fund of the Chemical Society has been established for the purpose of assisting investigators by defraying the cost of expensive materials. In future the income accruing from the munificent donations received from the Goldsmiths' Company and from the Perkin Memorial Fund will be devoted as far as possible to the encouragement of research in (*a*) metallurgical and inorganic chemistry and (*b*) the chemistry of coal-tar products, respectively.

The Committee meets twice a year to consider applications for grants; and forms of application, which can be obtained from the Assistant Secretary, must be lodged with the Secretaries by the end of May and November in each year.

NAMES OF HONORARY AND FOREIGN MEMBERS.

NUMBER NOT TO EXCEED FORTY.

Date of Election.	
Jan. 20, 1898	Arrhenius, Prof. Dr. Svant August, Bergsgaten 18, Stockholm
May 18, 1876	Baeyer, Geh. Rath Prof. Dr. Adolph von, F.R.S., Arcis-str. 1, Munich
Feb. 2, 1888	Boisbaudran, Lecoq de, Rue de Longchamp 113, Passy, Paris
June 19, 1862	*Cannizzaro, Prof. Stanislao, F.R.S., Reale Università, Rome
May 18, 1904	Clarke, Prof. Frank Wigglesworth, LL.D. (Aberd.), United States Geological Survey, Washington, D.C., U.S.A.
May 18, 1904	Curie, Madame Marie, La Sorbonne, Paris
Jan. 20, 1898	Curtius, Geh. Rath Prof. Dr. Theodor, Universität, Heidelberg
June 16, 1892	†Fischer, Geh. Rath Prof. Dr. Emil, F.R.S., Hessischestrasse 1, Berlin, N, Germany
Feb. 1, 1883	Fittig, Prof. Dr. Rudolph, Universität, Strassburg
Jan. 20, 1898	Franchimont, Prof. Dr. Antoine Paul Nicolas, Rapenburg 104, Leyden
Feb. 6, 1908	Gautier, Prof. Armand Emile Justin, 9, Place-des-Vosges, Paris
June 16, 1892	Graebe, Prof. Dr. Carl, Westendstrasse 28, Frankfurt-am-Main, Germany
Feb. 6, 1908	Haller, Prof. Albin, 10, Rue-Vauquelin, Paris
Feb. 6, 1908	Hittorf, Dr. Johann Wilhelm, Westfälische Wilhelms-Universität, Münster, Westfalen, Prussia
Feb. 2, 1888	Hoff, Prof. Dr. Jacobus Henricus van't, F.R.S., Lietzenburgerstrasse 54, Berlin, 15, W., Germany
Jan. 20, 1898	Körner, Prof. Wilhelm, R. Scuola Superiore d'Agricoltura, Milan
Feb. 2, 1888	Ladenburg, Geh. Reg.-Rath Prof. Dr. Albert, Kaiser Wilhelmstrasse 108, Breslau
Feb. 2, 1888	Landolt, Geh. Rath Prof. Dr. Hans, Kaiserallee 222, Berlin, W.
Feb. 6, 1908	Le Bel, Joseph Achille, 250, Rue Saint Jacques, Paris
Feb. 6, 1908	Le Chatelier, Prof. Henri Louis, 73, Rue Notre Dame des Champs, Paris
June 16, 1892	Lieben, Prof. Dr. Adolph, Mölkerbastei 5, Vienna I., Austria
May 18, 1904	Liebermann, Geh. Rath Prof. Dr. Carl, Matthäikirchstrasse 29, Berlin, W., Germany
March 4, 1909	Lunge, Georg, Prof., Ph.D. (Breslau), Hon. Dr. Ing. (Karlsruhe), Rämisstrasse 56, Zürich, Switzerland
May 18, 1904	Morley, Prof. Edward Williams, Hon. D.Sc. (Yale), West Hartford, Conn., U.S.A.

* Faraday Lecturer, 1872.

† Faraday Lecturer, 1907.

Date of Election.	
Jan. 20, 1898	*Ostwald, Geh. Rath Prof. Dr. Wilhelm, LL.D. (Aberd.), Grossbothen, Kgr., Sachsen
Jan. 20, 1898	Remsen, Prof. Ira, Johns Hopkins University, Baltimore, U.S.A.
Feb. 6, 1908	Richards, Prof. Theodore William, S.B. and Hon. LL.D. (Haverford), A.M. and Ph.D. (Harvard), Hon. Sc.D. (Yale), Hon. Ph.D. (Prague), Harvard University, Cambridge, Mass., U.S.A.
June 16, 1892	Schiff, Prof. Dr. Hugo, Via Gino Capponi 3, Florence, Italy
June 16, 1892	Schlœsing, Prof. Dr. Théophile, Institut Agronomique, Paris
Jan. 20, 1898	Spring, Prof. Walthère, Rue Beckmann 32, Liége, Belgium
Jan. 20, 1898	Troost, Prof. Louis Joseph, Rue Bonaparte 84, Paris
Jan. 20, 1898	Waals, Prof. Dr. Johannes Diderik van der, T.C., Hooftstraat 117, Amsterdam
Feb. 6, 1908	Wallach, Prof. Dr. Otto, Königl. Georg August Universität, Göttingen, Prussia.

* Faraday Lecturer, 1904.

FARADAY LECTURERS.

1869. Jean Baptiste André Dumas.
1872. Stanislao Cannizzaro.
1875. August Wilhelm von Hofmann.
1879. Charles Adolphe Wurtz.
1881. Hermann Ludwig Ferdinand von Helmholtz.
1889. Dmitri Ivanovitsch Mendeléeff.
1895. Lord Rayleigh.
1904. Wilhelm Ostwald.
1907. Emil Fischer.

LONGSTAFF MEDALLISTS.

1881. Thomas Edward Thorpe.
1884. Cornelius O'Sullivan.
1888. William Henry Perkin.
1891. Francis Robert Japp.
1894. Horace Tabberer Brown.
1897. William Ramsay.
1900. William Henry Perkin, jun.
1903. William Jackson Pope.
1906. Walter Noel Hartley.
1909. Frederic Stanley Kipping.

In order that the List of Fellows may be as complete as possible, those Fellows whose names and degrees do not appear in full are requested to communicate with the Assistant Secretary. Inaccuracies and changes of Address should be reported without delay.

NAMES OF FELLOWS.

‖ Denotes Life Members.
Trans. Denotes Members who have contributed Papers published in the Society's Transactions.
Proc. ,, ,, ,, ,, ,, ,, ,, ,, Proceedings.
C. ,, ,, ,, served on Council of the Society; P. as President; V.P. as Vice-President; T. as Treasurer; S. as Secretary; F.S. as Foreign Secretary.

Date of Election.			
1906			Abegg, Richard, Prof., Ph.D. (Berlin), Parkstrasse 13, Breslau 16, Germany
1903	Trans.		Abell, Robert Duncombe, D.Sc. (Wales), Ph.D. (Leipzig), F.I.C., University College of South Wales and Monmouthshire, Cardiff
1871	Trans.	C. 1882-4	Abney, Sir William de Wiveleslie, K.C.B., Hon. D.C.L. (Dun.), Hon. D.Sc. (Vict.), Sc.D. (Dub.), F.R.S., F.I.C., Rathmore Lodge, Bolton-gardens-south, S.W.
1883			Abraham, Alfred Clay, F.I.C., 87, Bold-street, Liverpool
1890			‖Abrines, Gustavus Anthony, Sanitary Commissioner's Office, Gibraltar
1875	Trans.		Acworth, Joseph John, Ph.D. (Erlangen), F.I.C., Thornbank, Shootup-hill, Brondesbury, N.W.
1905			Adam, Adam Lawson Kelly, 296, Bath-street, Glasgow
1892			Adams, Arthur, F.I.C., Kelvin House, Edgbaston-road, Smethwick
1877	Trans.		‖Adams, Matthew Algernon, F.R.C.S. (Eng.), F.I.C., The Kulm, Bearsted, near Maidstone
1892			Adcock, Samuel Robert, The St. Helens Smelting Co., Atlas-court, St. Helens, Lancs.
1896			Addie, Robert, Messrs. Kennedy and Addie, Norfolk House, Laurence Pountney Hill, E.C.
1881	Trans.		Adeney, Walter Ernest, Hon. D.Sc. (R.U.I.), A.R.C.S.I., F.I.C., Royal University of Ireland, Earlsfort-terrace, Dublin
1885	Trans.		Adie, Richard Haliburton, M.A. (Cantab.), B.Sc. (Lond.), 136, Huntingdon-road, Cambridge
1909			Adlam, George Henry Joseph, B.A. (Oxon.), 86, Southmoor-road, Oxford
1885			Adriance, John Sabine, Ph.D., Williams College, Williamstown, Mass, U.S.A.

Date of Election.		
1906		Agar, Shelton Gottlieb, La Fontaine, Clifton, Guernsey, Channel Islands
1905	Trans.	Ahlum, Charles Chester, c/o Messrs. G. W. Lord and Co., Philadelphia, Pa., U.S.A.
1908		Akers, Noel Charles, A.I.C., 26, King's-avenue, Muswell Hill, N.
1879		Albright, George Stacey, M.A. (Cantab.), Bromesberrow-place, Ledbury
1893		Albuquerque, John Pedrozo d', Prof., M.A. (Cantab.), F.I.C., Government Laboratory, Barbados, West Indies
1885		Alcock, Frank Harris, F.I.C., 9, Broad-street Corner, Birmingham
1892		Alcock, John While, Central Brewery, 45, Mott-street, Birmingham
1902		Alder, John Frederick, 28, Claverly-grove, Church-end, Finchley, N.
1903		Alderton, Gilbert John, B.Sc. (Lond.), F.I.C., 46, Westmount-road, Eltham Park, Kent
1886		Allan, James Henry, 45, Walton-vale, Liverpool
1896		Allan, John, 77, Northern-grove, West Didsbury, near Manchester
1907		Allan, John Campbell, 91, Norse-road, Scotstoun, Glasgow
1907		Allen, Alfred Frederick, B.Sc. (Lond.), 35, Purrett-road, Plumstead, S.E.
1894		Allen, Frederick John, Phœnix Chemical Works, Upper North-street, Poplar, E.
1901		Allen, Frederick Thomas, B.Sc. (Dun.), 32, Currock-terrace, Carlisle
1870		Allen, John, Phœnix Chemical Works, Upper North-street, Poplar, E.
1904		Allen, William Harold Richard, c/o Straits Trading Co., Butterworth, Penang, Straits Settlements
1894		Allibon, George Henry, Mayfield, Lisburn-road, Balmoral, Belfast
1905		Allison, James Albert, Luchana Laboratory, Apartado 45, Bilbao, Spain
1908	Trans.	Allmand, Arthur John, M.Sc. (L'pool), Muspratt Laboratory, The University, Liverpool
1899		Allworthy, James Herbert, Emanuel School, Wandsworth Common, S.W.
1899		‖Allworthy, Samuel William, M.A., M.D., B.Ch., L.M. and D.P.H. (Dub.), The Manor House, Antrim-road, Belfast
1903		Alton, William Lester St. John, F.I.C., 11, Briar-walk, Putney, S.W.
1885	Proc.	‖Amphlett, Edward Greenhill, M.A. (Oxon.), 3, Union-place, Worthing
1890		Anderson, Frederic Alfred, B.Sc. (Lond.), F.I.C., 31a, Clanricarde-gardens, W.

Date of Election.			
1895			Anderson, Herbert, Royal Latin School, Buckingham
1899			Anderson, James William, The Paddock, Halling, near Rochester
1906			Anderson, Robert, Chester-road-west, Sunderland
1901	Trans.		Anderson, William Carrick, M.A., D.Sc. (Glas.), 7, Scott-street, Garnethill, Glasgow
1892			Anderson, William Smellie, Christmas Island, Straits Settlements
1908			Andreae, Edward Philip, Ph.D. (Berlin), Crestalba, Champion Hill, S.E.
1905	Trans.		Andrews, Albert Edward, St. Hilda, 20, Carew-road, Thornton Heath, Surrey
1888			Andrews, Edward Arthur, St. Mary's Hospital, Paddington, W.
1882			‖Andrews, Launcelot Winchester, Ph.D. (Göttingen), 3731, Westminster-place, St. Louis, Mo., U.S.A.
1905	Trans.		Angel, Andrea, M.A. and B.Sc. (Oxon.), 17, Banbury-road, Oxford
1877			Angell, John, F.I.C., 6, Beacon's-field, Derby-road, Withington, Manchester
1898	Trans.		Annable, Henry William Coupe-, Gresham House, Egham, Surrey
1909			Annett, Harold Edward, B.Sc. (Lond.), Agricultural Research Institute, Pusa, Bengal, India
1905			Anthony, Charles, jun., M.Inst. C.E., Casilla de Correo, 149, Bahia Blanca, Argentine, S. America
1879			‖Appleby, Herbert, 2, John Dalton-street, Manchester
1903			Appleyard, George Henry, F.I.C., 4, Ash-grove, Beverley-road, Hull
1890	Trans.		Appleyard, James Robert, Royal Technical Institute, Salford
1903			‖Appleyard, Percy, Albany, Western Australia
1884			Archbutt, Leonard, F.I.C., The Yews, Madeley-street, Derby
1875			Armistead, William, M.B. and C.M. (Edin.), Stapleford, Cambridge
1900	Proc.		Armitage, Francis Paul, 13, Palliser-road, West Kensington, W.
1903	Trans.		‖Armstrong, Edward Frankland, D.Sc. (Lond.), Ph.D. (Berlin), c/o Messrs. Huntley & Palmers, Reading
1899			Armstrong, Frederick William, 6, St. Thomas's-terrace, Wells, Somerset
1870	Trans.	C.1873-5 S. 1875-93 P.1893-5	‖Armstrong, Henry Edward, Prof., LL.D. (St. Andrews), Ph.D. (Lips.), F.R.S., 55, Granville-park, Lewisham, S.E.; and Central Technical College, Exhibition-road, S.W.
1905			Arnaud, Francis William Frederick, F.I.C., Chemical Laboratory, 16, Arundel-street, Portsmouth
1909			Arnfield, Harold, Peak Lodge, Buxton-road, Stockport
1906	Trans.		Arup, Paul Seidelin, M.A. (Nova Scotia), 62, Haverstock Hill, N.W.

Date of Election.			
1894			Ashdown, Charles Henry, Monastery-close, St. Albans
1903			Ashdown, Herbert Henry, 88, Southgrove-road, Sheffield
1900			Ashton, James, Hacken Sewage Works, Moses-gate, Bolton
1905			Ashwell, James Henry, 117, Waterloo-crescent, Nottingham
1901			Aspinall, Thomas, 62, Gilnow-road, Bolton
1900	Trans.		Aston, Bernard Cracroft, N.Z. Agricultural Dept., Wellington, New Zealand
1901	Trans.		Aston, William George, 12, Douglas-road, Goodmayes, Ilford, E.
1903			Atkinson, Harford Montgomery, B.Sc. (Wales), Ph.D. (Göttingen), 69, George-street, Limerick, Ireland
1872	Trans.		‖Atkinson, Robert William, B.Sc. (Lond.), F.I.C., 44, Stuart-street, Cardiff
1862	Trans.	C. 1874-8	‖Attfield, John, Prof., M.A. and Ph.D. (Tübingen), F.R.S., F.I.C., Ashlands, Watford, Herts.
1903	Trans.		Attwell, Herbert Moore, A.R.C.S., 7, St. Margaret's-villas, Bradford-on-Avon.
1872	Trans.		‖Attwood, George, M.Inst.C.E., Steyning Manor, Stogursey, Somerset; and Mansion House Chambers, 13, Sise-lane, Queen Victoria-street, E.C.
1908			Aubertin, Thomas, B.A. (Oxon.), Maybank, Carnoustie, N.B.
1903			Aubrey, Henry James, The Cross, Worcester
1895	Trans.		‖Auden, Harold Allden, Central Laboratory, United Alkali Co., Widnes
1886			‖Audley, James Aloysius, B.Sc. (Lond.), A.R.C.S., F.I.C., 17, Gladstone-place, Hanley
1906	Trans.		‖Austin, Percy Corlett, M.A. (Cantab.), University College, Reading
1892			Avery, David, Working Men's College, Melbourne, Australia
1896			Aykroyd, Henry Edward, Scaitcliffe, Queen's-road, Ilkley
1891			Aylan, John Charles, 200, Eglinton-road, Shooter's-hill, Woolwich
1908			Ba, Maung, B.A. (Calcutta), Rangoon College, Rangoon, Burma
1903			‖Badcock, William Cornish, M.A. (Cantab.), The Grammar School, Crediton, Devon
1907	Trans.		Bagley, George, c/o Young's Chemical Works, 41B, Kent-terrace, Wellington, New Zealand
1904			Baguley, Allan, B.Sc. (Wales), F.I.C., Harris Institute, Preston
1907			Bailey, Francis James, Findon Hill, Sacriston, Durham
1875	Trans.		‖Bailey, George Herbert, Ph.D. (Heidelberg), D.Sc. (Lond.), The University, Manchester; and Marple Cottage, Marple, Cheshire
1893			Bailey, Henry, Parkview, Cheam-road, Worcester-park, Surrey
1900	Trans.		Bain, Alexander William, B.A. and B.Sc. (Lond.), F.I.C., Fairlight, Muswell-rise, Muswell Hill, N.

Date of Election.			
1884			‖Bain, Daniel, United Alkali Co., Ltd., Allhusen's Works, Gateshead-on-Tyne
1891			Bairstow, John, Burley, Queen's-park, Chester
1901			Baker, Arthur, 2, Carlton-avenue, Horn's Cross, Greenhithe, S.O., Kent
1889			‖Baker, Charles Frederic, B.Sc. (Lond.), Ph.D. (Strassburg), Technical College, Sunderland
1883	Trans.		‖Baker, Charles John, The Schools, Shrewsbury
1899			Baker, Clement Harrison, c/o Messrs. C. Harrold & Co., 2 and 3, St. Paul's-square, Birmingham
1907	Trans.		Baker, Frank, B.Sc. (Lond.), A.I.C., Royal Gunpowder Factory, Waltham Abbey, Essex
1902			Baker, Frederick Guy Stirling, M.A. (Oxon.), A.I.C., Marryatt's Lodge, Snaresbrook, Essex
1900			Baker, Frederick Nolan, Lieut., R.A., c/o Messrs. W. T. Allen & Co., 132, Queen Victoria-street, E.C.
1881	Trans.		Baker, Harry, F.I.C., Epworth House, Moughland-lane, Runcorn, Cheshire
1884	Trans.	C. 1899-03	‖Baker, Herbert Brereton, M.A. and D.Sc. (Oxon.), F.R.S., Christ Church, Oxford
1893	Trans.	C. 1908-	Baker, Julian Levett, F.I.C., Stainesbury Holt, Kingston-road, Staines
1908	Proc.		Baker, Thomas James, D.Sc. (Lond.), B.Sc. (Birm.), Trebarwith, Chester-road, Erdington, Birmingham
1901			Baker, Thomas Thorne, 15, Grosvenor-gardens, Cricklewood, N.W.
1908			Baker, William Henry Benson, B.A. (Oxon.), Frognal Dene, Hampstead, N.W.
1873			Baldock, John Henry, Overdale, St. Leonard's-road, Croydon
1901	Trans.		Ball, Walter Craven, B.A. (Oxon.), Warren Cottage, Hayes, Kent, and Guy's Hospital, S.E.
1907			Ball, William Robert, B.Sc. (Lond.), 48, Cambridge-road, Thornaby-on-Tees
1892			‖Ballantyne, Horatio, F.I.C., 75, Chancery-lane, W.C.
1908			Ballantyne, William Henry, B.Sc. (Glas.), 99, Holmdene-avenue, Herne Hill, S.E.
1896			Ballingall, William, M.A. (St. Andrews), Ardarrock, Dundee
1891	Trans.	C. 1905-08	Baly, Edward Charles Cyril, F.R.S., F.I.C., University College, Gower-street, W.C.
1886			Bamber, Henry Kelway George, Ingress House, Greenhithe, Kent
1890	Proc.		Bamber, Montague Kelway, F.I.C., The Laboratory, Hyde-park-corner, Colombo, Ceylon
1896			Banerjee, Gopal Chandra, Kaiser Soap Co., Cawnpore, India
1907			Banks, Arthur John, Rake-lane, Eastham, Birkenhead
1906			Banner, George Ernest, 10, Highfield-road, Rock Ferry, Cheshire

Date of Election.		
1904	Trans.	Barbour, William, M.A. and B.Sc. (St. Andrews), F.I.C., Dalswinton, 26, All Saints'-road, Peterborough
1905		Barbrook, George Henry, c/o Messrs. T. Prentice & Co., Stowmarket, Suffolk
1880		||Barclay, Arthur Edward, 95, Farringdon-street, E.C.
1903	Trans.	||Barger, George, M.A. (Cantab.), D.Sc. (Lond.), The Goldsmiths' College, New Cross, S.E.
1906		Barker, Arthur Ernest, B.A. and B.Sc. (Lond.), Royal Grammar School, Colchester
1890		||Barker, Joseph, Rev., M.A. and D.D. (Oxon.), Newton House, Newton, near Nottingham
1903	Trans.	Barker, Thomas Vipond, B.A. and B.Sc. (Oxon.), Mineralogical Dept., University Museum, Oxford
1896		Barker, William Henry, B.Sc. (Lond.), Addiscombe, Empress-avenue, Wanstead Park, Essex
1870		Barklie, Robert, Faunmore, Strandtown, Belfast
1894		Barlet, Stéphane, B. ès Sc. (Gall.), 97, St. Mark's-road, North Kensington, W.
1897		Barlow, Herbert William Leyland, M.A. and M.D. (Oxon.), M.R.C.S. and L.R.C.P. (Lond.), D.P.H., (Cantab.), Holly Bank, Croftsbank-road, Urmston, Manchester
1897	Trans.	Barlow, William, F.R.S., The Red House, Stanmore, Middlesex
1891		Barnes, Edward Arthur, 194, Hammersmith-road, W.
1905		Barnes, James Hector, Prof., B.Sc. (Birm.), F.I.C., Government College of Agriculture, Lyallpur, Punjab, India
1875		||Barnes, Richard Leburn, Phœnix Chemical Works, Hackney Wick, N.E.
1907	Trans.	Barnett, Edward de Barry, University College, Gower-street, W.C.
1908		Barr, Guy, B.A. (Cantab.) B.Sc. (Lond.), Pyrmont, Clarence-road, Teddington, Middlesex
1888		||Barraclough, William Herbert, F.I.C., Mortomley, near Sheffield
1891		Barratt, John Treeby, Bronheulog, Mostyn, North Wales
1869		Barret, Edward Louis, B.Sc. (Lond.), F.I.C., 12, Avenue de la Grande Armée, Paris
1906	Trans.	Barrett, Ernest, B.Sc. (Lond.), 121 Algernon-road, Lewisham, S.E.
1908		Barrett, Maurice, Cliff Lawn, Hyde-park, Leeds
1901		Barrie, Thomas Stewart, 4, Newton-street, Charing-cross, Glasgow
1905	Trans.	Barrowcliff, Marmaduke, F.I.C., 82, Highfield-road, Dartford, Kent
1872		||Barton, Robert, Royal Mint, Melbourne, Australia

Date of Election.			
1908			Barton, Robert, jun., 1, Fairfield-avenue, Fairfield, Droylsden, Manchester
1898			Baskerville, Charles, B.Sc. (Virginia), Ph.D. (N. Carolina), College of the City of New York, New York City, U.S.A.
1864	Trans.	C. 1870-3, 90-3	‖Bassett, Henry, F.I.C., 26, Belitha-villas, Barnsbury, N.
1907	Trans.		Bassett, Henry, jun., D.Sc. (Lond.), Ph.D. (Munich), D. ès Sc. (Nancy), F.I.C., The University, Liverpool
1891			Bate, William, Upton Villa, Hayle, Cornwall
1893			Bateman, John, Clovelly, 14, Stirling-road, Clapham Rise, S.W.
1896			Bathurst, Charles, B.A. (Oxon.), 3, Stone-buildings, Lincoln's Inn, W.C.
1905			Baxter, John George, River View, Burch-road, Rosherville
1896			Bay, Lauritz Hansen, B.Sc. (Lond.), The Grammar School, Wirksworth, Derbyshire
1892			Bayliss, Charles, Mino, Castle Bromwich, near Birmingham
1906			Bayliss, William Heath, Brewery House, Ashwell, Herts.
1874			‖Bayne, James, 31, Vaughan-terrace, Harrow
1879			‖Bayne, William Thirlwall, LL.D. (Cantab.), Brockhill, Broadclyst, Exeter
1897			Beadle, Alec Alfred, Wenden, Dawlish
1891	Trans.		Beadle, Clayton, Oak Bank, Lansdown-road, Sidcup, S.O., Kent
1861			‖Beadnell, Charles Edward, Major, R.A., Hafod, Llandinam, S.O., Montgomeryshire
1903			Beadnell, Charles Marsh, M.R.C.S. (Eng.), L.R.C.P. (Lond.), Fleet Surgeon, H.M.S. King Alfred, China Station
1867			Beale, William Phipson, K.C., M.P., 10, New-court, Carey-street, Lincoln's Inn, W.C. ; and 2, Whitehall-court, S.W.
1905			Bealey, Edward Williams, B.A. (Cantab.), 11, Kildare-gardens, Bayswater, W.
1903			Beam, William, M.A., M.D. (Penn.), F.I.C., Chemical Laboratory, Gordon College, Khartoum, Soudan
1899			Bean, Percy, 17, Dickinson-street, Manchester
1902			Beanes, Alfred Edward, Falcon Works, Wallis-road, Hackney Wick, N.E.
1864			‖Beanes, Edward, Moatlands, Paddock Wood, Kent
1890			Beardmore, George Russell, L.R.C.P. (Lond.), M.R.C.S. (Eng.), L.S.A., D.P.H. (Cantab.), Warwick House, Upper-street, Islington, N.
1901			Beaven, Edwin Sloper, Eastway, Warminster
1890	Trans.		Beck, Charles Ridgeway, F.I.C., 53, Norroy-road, Putney, S.W.
1874	Trans.		‖Beckett, George Henry, F.I.C., 35, South Beach-road, Ardrossan, N.B.
1906			Beckett, Richard Henry, Prof., B.Sc. (Lond.), The College, Nagpur, C.P., India

Date of Election.			
1901			Bedford, Frederick, B.Sc.(Lond.), Ph.D. (Halle), 9, Market-place, Sleaford, Lincs.
1879	Trans.	C. 1895-9	Bedson, Peter Phillips, Prof., M.A. (Dun.), D.Sc. (Lond. and Dun.), B.Sc. (Vict.), F.I.C., Armstrong College of Science, Newcastle-on-Tyne
1901			Bedwell, John Cardew, B.Sc. (Lond.), 65, High-street, Colchester
1905			Bees, William James, B.Sc. (Lond.), 43, Ash-grove, Hyde-park, Leeds
1899			Beesley, Frederick Arnold, B.Sc. (Lond.), 7, Whitmore-road, Beckenham, Kent
1872	Trans.	C. 1907-	‖Beilby, George Thomas, Hon. LL.D. (Glas.), F.R.S., F.I.C., 11, University-gardens, Glasgow
1891			Belbin, Tom St. John, Capt., Nortonthorpe Hall, near Huddersfield
1891			‖Bell, Albert Edward, F.I.C., 59, Trinity-square, Southwark, S.E.
1886	Trans.		Bell, Chichester Alexander, B.A. and M.B. (Dub.), F.I.C., Torbrex, Headington-hill, Oxford
1889			Bell, Edward Wightman, The Chantry, Spalding
1898			Bell, Hugh Poynter, M.A. (Cantab.), 17, Tothill-street, Westminster, S.W.
1865	Trans.		‖Bell, J. Carter, A.R.S.M., F.I.C., The Cliff, Higher Broughton, Manchester
1907			Bell, John Forbes, Craigmillar, Edinburgh
1889			‖Bell, Percy Carter, F.I.C., Milburn, New Jersey, U.S.A.
1906			Bell, William Edward, Langholm, Yarborough-road, Lincoln
1904	Trans.		Bellars, Albert Ernest, B.A. (Cantab.), Magdalene College, Cambridge
1905			Belton, Francis George, 336, Belgrave-road, Birmingham
1879			Bemrose, Joseph, F.I.C., 56, St. Famille-street, Montreal, Canada
1874			‖Bendix, David, F.I.C., Sutherland Lodge, 371, Romford-road, Forest Gate, E.
1902	Proc.		Bengough, Guy Dunstan, M.A. (Cantab.), The University, and 25, Huskisson-street, Liverpool
1902			Benham, Keith Benham, B.Sc. (Lond.), F.I.C., Dean's Hill, Stafford
1881			‖Benjamin, Marcus, A.M. (Lafayette), Ph.B. (Columbia), Ph.D. (Nashville), Sc.D. (Pennsylvania), U.S. National Museum, Washington, D.C., U.S.A.
1904			Benn, Robert Haslam Durward, 112, St. Francois Xavier-street, Montreal, Canada
1900	Trans.		Bennett, Alexander Hutcheon, c/o Messrs. G. H. Ogston & Moore, Catania, Sicily
1904			Bennett, Charles Thomas, B.Sc. (Lond.), F.I.C., 102, Queen's-road, Wimbledon, S.W.

Date of Election.			
1903			Bennett, Colin Noël, Escot, Penzance, Cornwall
1909	Trans.		Bennett, Hugh Garner, M.Sc. (Leeds), 13, Spring-grove-terrace, Leeds
1905			Bennett, Joseph, Windsor Printing Co., North Adams, Mass., U.S.A.
1892	Trans.		Bensusan, Arthur John, The Ouro Preto Gold Mines of Brazil, Ltd., Minas de Passagem, Ouro Preto, Brazil
1904			Bentley, Walter Henry, M.A. (Oxon.), Merton, Everton-road, Addiscombe, Croydon
1896	Trans.		Bentley, William Henry, B.Sc. (Vict.), 12, Cromwell-terrace, Irlam, near Manchester
1907			Benton, Frank Stanley, Hursthead, Reigate, Surrey
1890			Bentz, Ernest, 107, Shaw-lane, Dinting, near Manchester
1902	Trans.		Bergtheil, Cyril, Research Station, Sirseah, Mozufferpore Post Office, T. S. Railway, India
1882			‖Beringer, John Jacob, A.R.S.M., F.I.C., Basset-road, Camborne, Cornwall
1895	Trans.		Berkeley, The Rt. Hon. Randal Thomas Mowbray, The Earl of, F.R.S., Foxcombe, Boar's Hill, Oxford
1890			‖Berncastle, Richard, 15, Ladbroke-gardens, Notting Hill Gate, W.
1893			Berridge, Douglas Jesse Penfold, M.A. (Oxon.), The Laboratory, Malvern College
1906			‖Berry, Arthur John, B.A. (Cantab.), 5, University-gardens, Glasgow
1882			‖Berry, Edward Elhanan, F.I.C., 44, London Wall, E.C.
1898			Berry, Reginald Arthur, Prof., F.I.C., The West of Scotland Agricultural College, 6, Blythswood-square, Glasgow
1891			Berry, Thomas William, Education Office, Pentre, Rhondda, Glam.
1888	Proc.		Berry, William, 7, Hampton-park, Redland. Bristol
1906			Bethea, Oscar Walter, Prof., M.D. (Miss.), Ph.G. (Atlanta), Mississippi Medical College, Meridian, Miss., U.S.A.
1883	Trans.	{C. 1898-1900}	‖Bevan, Edward John, F.I.C., 3, New-court, Carey-street, W.C.
1908			Bevan, Edward Morris, 105, High-street, Kenfig-hill, Bridgend
1886			Bevan, John Williams, F.I.C., Risedale, St. James-crescent, Swansea
1903			Beveridge, Wilfred William Ogilvy, Major, R.A.M.C., D.S.O., M.B. (Edin.), D.P.H. (Cantab.), R. Army Clothing Dept., Grosvenor-road, S.W.
1897			Bhaduri, Jyoti Bhushan, M.A. (Calcutta), Krishnaghur College, Krishnaghur, Dist. Nadia, Bengal, India
1903			Bhaduri, K., Prof., M.A. (Calcutta), Canning College, Lucknow, India
1908			Bhunsri, Prince Mom Chow, Saranrome Palace, Bangkok, Siam
1903			Bibby, Charles Drake, 69, Queen's-road, Twickenham, Middlesex

Date of Election.		
1903		Bibby, Robert Gordon, York Hotel, Albemarle-street, W.
1865		‖Bickerdike, William Edward, F.I.C., Bryers Croft, Wilpshire, near Blackburn
1908		Bickerstaffe, Robert, Chilterns, Wooburn-green, Bucks.
1901		‖Bickford, Harding, 46, Currie-street, Adelaide, South Australia
1875		Biggart, John William, F.I.C., Chemical Laboratory, 29, Cathcart-street, Greenock
1881		Bingley, John, Northampton
1900		Binks, Frederick Nisbet, 29, Beech-grove, Whitley Bay, Northumberland
1908		Birch, William Colet, B.A. (Cantab), A.I.C., 22, Glazbury-road, West Kensington, W.
1894		Bird, William Rowland, Chem. Lab., G.W.R. Works, Swindon
1898		Birkett, Walter, 28, Carline-road, Lincoln
1906		Birt, Roderick Harold Capper, Rev., B.A. (Oxon.), St. Peter' College, Radley, Abingdon
1879		‖Black, Andrew Heggie, St. John's, Wakefield; and Moo Lodge, Harrogate
1904		Black, John Wyclif, 20, Mardale-crescent, Edinburgh
1909		Blackburn, Albert Riley, B.Sc. (Lond.), A.R.C.S., Marshville Derby-road, Widnes
1886		Blackburn, Thomas, 580, Coventry-road, Birmingham
1899	Trans.	Blackman, Walter Lionel, Stanthorpe-road, Streatham, S.W.
1903		Blackshaw, George Neville, B.Sc. (Wales), Government School o Agriculture, Elsenburg, Mulder's Vlei, Cape Colony, S. Africa
1899		Blackshaw, John Frank, The Midland Dairy Institute, Kingsto Fields, Derby
1902		Blair, Herbert, 23, Ashley-road, West Harton, South Shields
1901		Blake, George Stanford, 15, Vernon-street, Broughton, Mancheste
1890	Trans.	Blake, Robert Frederick, F.I.C., Chemical Department, Queen' College, Belfast
1890		Blake, William Henry, 12, Lombard-street, Newcastle-on-Tyne
1875		‖Blanshard, Charles Thomas, M.A. (Oxon.), Bebington Birkenhead
1906		Blatchley, Charles Frederick Polwhele, B.A. (Oxon.), 1 Templars-avenue, Golders Green, N.W.
1892		Bleckly, Arthur Sanderson, Marldon, Thelwall, Warrington
1902		Blenkinsop, Richard, c/o Messrs. May & Baker, Ltd., Garde Wharf, Church-road, Battersea, S.W.
1890		Blenkinsop, William Edmund Brandford, c/o Messrs. May an Baker, Ltd., Garden Wharf, Church-road, Battersea, S.W.
1909		Bletcher, Henry Ernest John, Prof., College of Pharmacy Winn peg, Manitoba, Canada

Date of Election			
1903			Bliss, Henry James Wheeler, M.A. (Oxon.), 17, Victoria-street, S.W.
1899			Blofeld, Stuart, Rev., B.A. and B.Sc. (Lond.), Saltley Training College, Birmingham.
1896			‖Blood, Maurice, M.A. (Oxon.), 16, Alexandra-road, Kingston-on-Thames
1891			Bloomer, Frederick John, F.I.C., Penpont, Clydach, S.O. Glamorgan
1890	Trans.		Blount, Bertram, F.I.C., 76 and 78, York-street, Westminster, S.W.
1888			Bloxam, Arthur George, F.I.C., 105, Birkbeck Bank-chambers, Southampton-buildings, W.C.
1883	Trans.		‖Bloxam, William Popplewell, Prof., B.Sc. (Lond.), F.I.C., c/o Messrs. Smith, Fawdon & Low, 12, Bread-street, Cheapside, E.C.
1903			Bluman, Nicholas John, c/o Messrs. Bluman & Stern, Ltd., Plough-bridge, Deptford, S.E.
1887			Blundstone, Edwin Richardson, B.A. (Cantab.), Heathfield, Hampton Hill, Middlesex
1865	Trans.		Blunt, Thomas Porter, M.A. (Oxon.), F.I.C., Tower-place, Shrewsbury
1896			Blyde, Joseph Edwin Alger, Merlin House, Broomgrove-road, Sheffield
1875	Trans.		Blyth, Alexander Wynter, M.R.C.S. (Eng.), L.S.A. (Lond.), F.I.C., 26, Avenue-road, Regent's Park, N.W.
1892			Blyth, Meredith Wynter, B.A. (Cantab.), B.Sc. (Lond.), F.I.C. The Lodge, Ardsley, Barnsley
1908	Trans.		Blyther, Donald Francis, B.Sc. (Lond.), A.R.C.S., 77, Knights-road, Silvertown, E.
1875			‖Boake, Arthur, Chemical Works, Stratford, E.; and Highstanding, Loughton, Essex
1902			Boardman, Ernest, B.Sc., (Vict.), 619, St. Helens-road, Bolton
1878			Bodmer, Richard, F.I.C., Analytical Laboratory, 16, Southwark, street, S.E.
1898			Bogert, Marston Taylor, Prof., B.A. and Ph.B. (Columbia), Columbia University, New York City, U.S.A.
1906			Bogue, Thomas Going Stoney, 5, Kenilworth-square, Dublin
1869	Trans.		‖Bolas, Thomas, F.I.C., 60, Grove-park-terrace, Chiswick, W.
1901			Bolton, Edward Richards, 16, Flanchford-road, Ravenscourt Park, W.
1899			‖Bond, Alfred Ernest, Peterbrook, Warstock, near Birmingham
1883			Bond, Henry Charles, Rev. M.A. (Oxon.), Belle Vue Hall, Brighton
1893	Trans.	C. 1909-	‖Bone, William Arthur, D.Sc. (Vict.), Ph.D. (Heidelberg), F.R.S., West House, 18, Lidgett-park-road, Roundhay, Leeds

Date of Election.		
1893		Boone, William Thomas, B.Sc. (Lond.), 6, Sydenham-villa Cheltenham
1884		Borland, William Dalrymple, F.I.C., Beacon Lodge, Gree Street Green, near Dartford, Kent
1881		||Borns, Henry, Ph.D. (Greifswald), 5, Sutton Court-road, Chiswick W.
1895		||Borradaile, Lancelot Alexander, M.A. (Cantab.), Selwyn College Cambridge
1861		||Bosanquet, Robert Holford Macdowall, M.A. (Oxon.), F.R.S. Castillo Zamora, Realijo Alto, Teneriffe, Canary Islands
1894	Proc.	Bose, Chuni Lal, Prof., 25, Mohendra Bose's-lane, Calcutta
1881		Bostock, George Henry, 217, Beatrice-street, Toronto, Canada
1881	Trans.	Bothamley, Charles Herbert, F.I.C., Tangle Wood, Southside Weston-super-Mare
1887	Trans.	Bott, William Norman, Ph.D. (Heidelberg), 16, St. Helens-place E.C.
1869		||Bottomley, James Thomson, B.A. (Dub.), M.A. and D.Sc (R.U.I.), Hon. LL.D. (Glas.), F.R.S., 13, University-gardens Glasgow
1886		Bottomley, William Beecroft, Prof., M.A. (Cantab.), Ph.D. 35, Downside-crescent, Hampstead, N.W.
1894		Boul, William Good, M.A. and LL.D. (Dub.), D.C.L. (Dun. Tideswell Grammar School, near Buxton
1901		Bousfield, Edward George Paul, The Saxon Engineering Co., Ltd. Fenton, Stoke-on-Trent
1905	Trans	Bousfield, William Robert, M.A. (Cantab.), K.C., St. Swithin' Hendon
1891		Bovell, John Redman, Dodd's Botanical and Experiment Station, Barbados, West Indies
1865		||Bowdler, Arthur Clegg, F.I.C., 20, Bank-terrace, Wellingto street, Blackburn
1888		Bower, Frank, c/o Messrs. Truman, Hanbury and Buxton, Spita fields, E.
1894		Bowes, Harry, F.I.C., Messrs. Bowes and Sims, 40, Radfor street, Blackley, Manchester
1906		Bowis, William John, Ph.D. (Zürich), 97, North-road, We Bridgford, Notts.
1899		Bowles, Bertram Hennessey, Overdale, Eastwood-road, Sout Woodford, N.E.
1896		Bowley, Joseph John, Wellington Works, Battersea Bridge S.W.
1893		Bowman, Frederic Edmund, 4, Albert-square, Manchester
1862		Bowman, Frederic Hungerford, F.I.C., Assoc. Inst. C.E. and M.E. 4, Albert-square, Manchester

Date of Election.		
1896		‖Bowman, Herbert Lister, M.A. (Oxon.), Greenham-common, Newbury, Berks.
1894	Trans.	Boyd, David Runciman, Prof., D.Sc. (Glas.), Ph.D. (Heidelberg), F.I.C., The Hartley University College, Southampton
1901		Boyers, Henry, 20, Knox's-street, Sligo
1869		‖Braby, Frederic, Bushey Lodge, Teddington
1903		Bradbury, Samuel, Ferncliff, Milton-grove, Glebelands-road, Ashton-on-Mersey, Cheshire
1895		Bradford, Henry, Pampas Cottage, Goodwood, Chichester
1876		‖Bradley, Nathaniel, Sunnyside, College-road, Whalley Range, Manchester
1888		Bradshaw, Charles, 169, Spring Vale-road, Sheffield
1906		Braid, Arthur Forbes, Sewaren House, Sewaren, N.J., U.S.A.
1908		Brakes, William Sudderick, 137, Steade-road, Sheffield
1894	Trans.	Brame, John Samuel Strafford, Royal Naval College, Greenwich, S.E.
1903		Branch, George Thomas, c/o Messrs. Strachan & Co., P.O. Box 112, Salisbury, Rhodesia, S. Africa
1882		Branson, Frederick Woodward, F.I.C., 14, Commercial-street, Leeds; and Wynneholme, Far Headingley, Leeds
1908		Braun, Marie Joseph Arsène, Ph.D. (Bâle), 5, Aspinall-road, Brockley, S.E.
1882	Trans.	Brauner, Bohuslav, Prof., Ph.D. (Prague), Hon. D.Sc. (Manc.), New Chemical Laboratory, Bohemian University, Prague, VI., Bohemia
1896		Bray, Daniel, 63, Morehampton-road, Donnybrook, Dublin
1905		‖Brettell-Vaughan,' Edward Shipley Hewitt Edwards, Cwm Cottage, The Cwm, Aston-on-Clun, Salop.
1883		Briant, Lawrence, 24, Holborn-viaduct, E.C.
1901		Bridges, Joseph Samuel, B.Sc. (Lond.), 45, Thistlethwaite-road, Clapton, N.E.
1904	Trans.	Bridgett, Robert Currie, M.A. and B.Sc. (St. Andrews), Dunlossit, Dryburgh-avenue, Rutherglen, Glasgow
1897		Brierley, James, 33 and 35, French-street, Southampton
1890	Trans.	Brierley, John Thomas, Highfield, Golden Hill, Leyland, near Preston
1898		Brierley, Joseph, B.Sc. (Vict.), Ashton-road, Failsworth, Manchester
1893	Trans.	Briggs, John Frederick, Auchmuty Paper Mills, Markinch, Fife, N.B.
1906		Briggs, Richard Victor, Research Station, Sirseah, Mozufferpore P.O., T.S. Railway, Bengal, India
1905	Trans.	Briggs, Samuel Henry Clifford, B.Sc. (Vict.), Greenbank, Cleckheaton, Yorks.

Date of Election.			
1883			‖Briggs, Thomas Lynton, F.I.C., 188, Central-avenue, Flushing, L.I., U.S.A.
1884			‖Briggs, William, LL.D., D.C.L., M.A., B.Sc., Burlington House, Cambridge
1902			Brincker, John Augustus Herman, B.A., M.B., B.C. and D.P.H. (Cantab.), B.A. (Cape of Good Hope), M.R.C.S. (Eng.), L.R.C.P. (Lond.), F.I.C., 8, Christ Church-road, Hampstead, N.W.
1900			Britten, Frank Curzon, B.A. (Oxon.), Odiham School, Odiham, Hants.
1889			Broadbent, Harry, F.I.C., 183, Hyde Park-road, Leeds
1879			‖Broadbent, John James, F.I.C., Waikino, Auckland, New Zealand
1883			Brock, John, J.P., F.I.C., Gwern-Tyno, Colwyn Bay, N. Wales
1893			‖Brockbank, John Edwin, The Croft, Kirksanton, viâ Carnforth
1898			Brooke, Arthur, M.A. (Cantab.), The Grammar School, Caistor, Lincs.
1900			Brooke, Charles Berjen, Colne House, Brantham, near Manningtree, Essex
1900			Brooke, John Richard, F.I.C., Office of Deputy Government Analyst, Penang, Straits Settlements
1906			Broome, James Spears, M.Sc. (Manc.), 18, Seedley-park-road, Pendleton, Manchester
1886	Trans.		‖Brothers, Horace Edward, B.Sc. (Lond.), F.I.C., Clooney-park, Londonderry
1876	Trans.		Brown, Adrian John, Prof., M.Sc. (Birm.), F.I.C., West Heath House, Northfield, Worcs.
1867	Trans.	C. 1872-4, V.P. 81-4, 90-1. P. 91-3	Brown, Alexander Crum, Prof., M.A., M.D., and F.R.C.P. (Edin.), D.Sc. (Lond.), LL.D. (Aberd. and Glas.), F.R.S., F.I.C., 8, Belgrave-crescent, Edinburgh
1870			Brown, David, F.I.C., 93, Abbey-hill, Edinburgh
1891			Brown, Edward Hilton, c/o Messrs. W. Ropes and Co., St. Petersburg, Russia
1873	Trans.	C. 1881-3	‖Brown, Frederic Douglas, Prof., B.Sc. (Lond.), University College, Auckland, New Zealand
1884			Brown, Frederic William, Ingleside, 39, Loveday-road, West Ealing, W.
1892			Brown, George Fitz-, A.R.S.M., F.I.C., The Broughton Copper Company, Ditton Copper Works, Widnes
1897			Brown, Gerald Noël, 20, Cullum-street, E.C.
1908			Brown, Harry James, Pembrey Lead Works, Burry Port, S.O., Carmarthenshire
1880			Brown, Henry, F.I.C., Benskin's Brewery, Watford, Herts.

Date of Election.			
1871	Trans.	C. 1883-7, V.P. 94-7, 1904-7 T. 1903-04 F.S. 1907-	†Brown, Horace Tabberer, LL.D. (Edin.), F.R.S., F.I.C., 52, Nevern-square, Kensington, S.W.
1908			Brown, James, 20, Tower-road, Dartford, Kent
1867	Trans.	V.P. 1908-	‖Brown, James Campbell, Prof., D.Sc. (Lond.), Hon. LL.D. (Aberd.), F.I.C., 8, Abercromby-square, Liverpool
1905			Brown, John Coggin, B.Sc. (Dun.), H.M. Geological Survey, Calcutta, India
1882			Brown, Joseph, Ashleigh House, Savile Town, Dewsbury
1892			Brown, Reginald Busby, c/o The Badische Co., Ltd., 2, Samuel Ogden-street, Manchester
1908			Brown, Walter, jun., County Offices, Hamilton, N.B.
1884			Brown, William George, Prof., Ph.D. (N. Carolina), B.S. (Virginia), University of Missouri, Columbia, Missouri, U.S.A.
1896			Browne, Charles Edward, B.Sc. (Lond.), Christ's Hospital, West Horsham, Sussex
1893			Browne, Frank, F.I.C., Government Civil Hospital, Hong Kong, China
1873			Brownen, George, Grove-road-east, Avon-park, Christchurch
1899	Trans.		Browning, Kendall Colin, Prof., M.A. (Cantab.), Medical College, Colombo, Ceylon
1890			Brownsword, Frank, M.Sc. (Vict.), F.I.C., Bryn Derwen, Old Colwyn, N. Wales
1902			Bruce, Alexander, B.Sc., The Laboratory, Hyde-park-corner, Colombo, Ceylon
1894	Trans.		Bruce, James, B.Sc. (Lond.), Ph.D. (Munich), A.R.C.S., F.I.C., The Technical College, Huddersfield
1901			‖Bruce-Kingsmill, Julian, Major, R.A., M.A. and B.Sc. (Glas.), c/o The Central Chemical Agency of Great Britain and Ireland, 4, St. Ann's-square, Manchester
1895			Bruckmann, Gustav Theodore, B.Sc., 192, Eighteenth-street, Brooklyn, N.Y., U.S.A.
1903			Brühl, Paul, Civil Engineering College, Sibpur, near Calcutta, India
1898	Trans.		‖Brünnich, Johannes Christian, F.I.C., Department of Agriculture, Brisbane, Queensland
1909			Brunskill, Hubert, 55, Abbotts-road, Southall
1893	Trans.		‖Brunton, John Dixon, c/o Prof. O. W. Richardson, Princeton, N.J., U.S.A.

† Longstaff Medallist, 1894.

Date of Election.		
1902		Bryant, Vernon Seymour, B.A. (Cantab.), Trelawne, Crowthorne, Berks.
1877	Trans.	‖Buch, Carl von, M.A. (Oxon.), F.I.C., 66, Paddington-street, W.
1877	Trans.	Buchanan, John Young, M.A. (Cantab.), F.R.S., F.I.C., 26, Norfolk-street, Park-lane, W.
1876		‖Buckmaster, Charles Alexander, M.A. (Oxon.), F.I.C., 16, Heathfield-road, Mill Hill Park, Acton, W.
1902		Bucknell, Edwin Thomas Holman, Kingsholme School, Weston-super-mare
1907	Trans.	Buckney, Frank, B.A. (Cantab.), Custom House, Madras, India
1903		Buggé, Erasmus Robert, 13, Prince's-avenue, Church End, Finchley, N.
1898	Trans.	Bull, Benjamin Samuel, M.A. and B.Sc. (N.Z.), Ph.D. (Munich), F.I.C., Greylands, 104, Humber-road, Blackheath, S.E.
1901		Bult, Herbert John, 18, Billiter-street, E.C.
1890		Bunting, Henry Herbert, Oficina de Ensayes F. C. C. del Peru, Callao, Peru
1896		Burbridge, James Kerry, F.I.C., The Orchard, Philip-lane, Tottenham, N.
1891		Burford, Samuel Francis, Beechworth, Stoneygate-road, Leicester
1894	Trans.	Burgess, Herbert Edward, Fairfield, Rolleston-road, Burton-on-Trent
1901		Burgess, Percival James, M.A. (Cantab.), Woodstock, Pinner, Middlesex
1884		Burgess, William Thomas, F.I.C., 20, Priory-road, Bedford Park, W.
1903		Burghard, William Godsell, 43, New Oxford-street, W.C.
1884		‖Burland, Jeffrey Hale, 342, Sherbrooke-street West, Montreal, Canada
1897		Burland, Richard Oxley, J.P., Poolstock House, Wigan
1901		‖Burnett, Theodore Ridley, B.Sc. (Vict.), Ph.D. (Bâle), The Grammar School, Kirkby Lonsdale, Westmoreland
1893		Burnham, John Charles, B.Sc. (Vict.), F.I.C., Cordite Factory, Wellington, Nilgiri Hills, India
1882	Trans.	Burrell, Benjamin Arthur, F.I.C., 8, Springfield Mount, Leeds
1902	Trans.	Burrows, Harry, Ph.D. (Heidelberg), A.R.C.S., F.I.C., The Green, Southgate, N.
1901	Trans.	Burrows, Merrick William, M.Sc. (Vict.), Dunkirk, Devizes
1905	Trans.	Burt, Bryce Chudleigh, B.Sc. (Lond.), Department of Agriculture, Cawnpore, India
1909	Proc.	Burt, Frank Playfair, B.Sc. (Lond.), Elmhyrst, Weston-super-mare

Date of Election.		
1891		Burton, William, Clifton Junction, near Manchester
1901		Burton, William, B.A. (Cantab.), B.Sc. (Wales), The Old Hall, Meaford, Stone, Staffs.
1903		Bury, Ernest, M.Sc. (Vict.), Brackley Coke Works, Little Hulton, near Bolton, Lancs.
1894		Bush, William, School of Science and Art, Free Library, Newport, Mon.
1904		Busher, Thomas Story, B.A. (Oxon.), Park Villa, Kendal
1890		Butcher, William James, B.Sc. (Lond.), Queen Elizabeth Grammar School, Ashbourne, Derbyshire
1895		Butler, David Butler, 41, Old Queen-street, Westminster, S.W.
1890		Butler, William Waters, Southfield, Norfolk-road, Edgbaston, Birmingham
1894		Buttemer, Robert William, St. Mary's, Godalming, Surrey
1875		Butterfield, John Cope, F.I.C., 79, Endlesham-road, Balham, S.W.
1892		Butterfield, William John Atkinson, M.A. (Oxon.), F.I.C., 66, Victoria-street, S.W.
1902		Buxy, Tarit Kanti, Prof., Govt. College, Jubbulpore, C.P., India
1888		Byrn, George Alexander, F.I.C., 97, Pitt-street, Sydney, N.S.W.
1906		Byrom, Thomas Henry, F.I.C., The Laboratory, Wigan Coal and Iron Co., Ltd., Wigan
1903		Bywaters, Hubert William, Ph.D. (Würzburg), A.R.C.S., F.I.C., 11, Kingly-street, W.
1903		Cadman, William Henry, B.Sc. (Wales), Ministry of Education, Cairo, Egypt
1893		‖Cahill, Robert Saunderson, Sunnyside, Heckmondwike
1894	Trans.	‖Cain, John Cannell, D.Sc. (Vict. and Tübingen), 28, Pembury-road, Clapton, N.E.
1906		Calam, Harold, M.Sc. (Leeds), B.Sc. (Manc.), F.I.C., 71, Cemetery-road, Beeston-hill, Leeds
1904		Caldecott, Lawrence, 56, Stanley-street, Fairfield, Liverpool
1898	Proc.	Caldecott, William Arthur, B.A. (Cape of Good Hope), Box 67, Johannesburg, S. Africa
1891		‖Calder, William Alexander Skeen, Ormidale, Little Moor-hill, Smethwick, near Birmingham
1907	Trans.	Caldwell, Kenneth Somerville, B.Sc. (Wales), Ph.D. (Leipzig), F.I.C., Chemical Laboratory, St. Bartholomew's Hospital, E.C.
1904	Trans.	Caldwell, Robert John, D.Sc. (Lond.), The Poplars, Bowes-park, New Southgate, Middlesex
1906	Trans.	Caldwell, William, M.A. (R.U.I.), Physiological Department, Trinity College, Dublin
1884		Caley, Edward James, Chapel Field Works, Norwich

Date of Election.		
1907		Callan, Thomas, M.Sc. (Manc.), Chemisches Laboratorium, Universität, Heidelberg, Germany
1903	Trans.	Calvert, Harry Thornton, Ph.D. (Leipzig), M.Sc. (Leeds), B.Sc. (Vict.), F.I.C., West Riding of Yorkshire Rivers Board, Wakefield, Yorks.
1900		Calvert, Sidney, A.M. (Harvard), B.Sc. (McGill Univ.), State University, Columbia, Miss., U.S.A.
1907	Trans.	Cameron, Alexander Thomas, M.A. and B.Sc. (Edin.), Chemical Laboratory, University College, Gower-street, W.C.
1875		Cameron, John Macdonald, F.I.C., Castle Hill, Tain, N.B.
1892		Campbell, Andrew, The Palms, Dunneedaw, Rangoon, Burma
1905		Campbell, Eric William, 10, Cambridge-gardens, Richmond Hill, Surrey
1903		Campbell, Thomas, 38, Eastbourne-street, Liverpool
1909		Campbell, Walter, c/o Messrs. J. A. Devenish & Co., Ltd., The Brewery, Weymouth
1898		Campion, Alfred, F.I.C., 144, Wellington-street, Glasgow
1896		Candy, Hugh Charles Herbert, B.A. and B.Sc. (Lond.), F.I.C., The College, London Hospital, E.
1898		Cannon, Matthew James, 16 and 17, Devonshire-square, Bishopsgate-street, E.C.
1900		Cantin, Angélo, Prof., Royal College of Mauritius, Vacoas, Mauritius
1888		Carey, Alfred Edward, M.Inst.C.E., 36, Victoria-street, S.W.
1892	Trans.	Carey, Arthur, B.Sc. (Vict.), 1, Grassendale-road, Grassendale, near Liverpool
1906		Carmichael, John, Government Laboratory, Clements Inn-passage, Strand, W.C.
1902		Carmichael, Thomas Burnell, 18, Eastdale-road, Wavertree, Liverpool
1889		Carmody, Patrick, Prof., F.I.C., Department of Agriculture, Port of Spain, Trinidad
1899	Trans.	‖Carpenter, Henry Cort Harold, Prof., M.A. (Oxon.), Ph.D. (Leipzig), The University, Manchester; and 11, Oak-road, Withington, Manchester
1908		Carpenter, John Arthur, B.A, (Oxon.), 23, Richmond-road, Exeter
1906		Carpenter, Percy Henry, A.I.C., Sugar Works, Cawnpore, India
1899		Carpmael, Wilfred, 24, Southampton-buildings, Chancery-lane, W.C.
1895	Trans.	Carr, Francis Howard, F.I.C., Kelvin, Church-avenue, Sidcup, S.O., Kent
1887		Carrington, George Carrington, Missenden Abbey, Great Missenden, Bucks.

Date of Election.			
1902			Carrodus, Fred, Glen Fern Tower, Lansdowne-road, Wimbledon, S.W.
1882			‖Carruthers, Robert, Kirkbank House, Dumfries
1893			Carswell, Thomas Retson, 29, Ingatestone-road, South Norwood, S.E.
1864		C. 1878-82, 84-8	‖Carteighe, Michael, F.I.C., Oriel, Goring, Reading
1901	Trans.		Carter, William, Sewage Works, Bury
1867			‖Carulla, Facundo Joaquin Ramon, Argyll-terrace, 84, Rose-hill-street, Derby
1895			Case, Thomas Bennett, B.A. (Oxon.), Brewers' Laboratory, Messrs. Guinness, Son & Co., Dublin
1879			‖Cassal, Charles Edward, Col., V.D., F.I.C., Town Hall, Kensington, W.
1894			Catherall, Ezra, A.R.C.S., Heathmere, Albany-road, Harborne, Birmingham
1907			Caton, Frederic William, B.A. (Oxon.), B.Sc. (Lond.), 6, King-street, Snow-hill, E.C.
1903			‖Caudwell, Ben, B.A. (Lond.), 28, Wigfull-road, Sheffield
1909			Caulkin, Howard Alfred, B.Sc. (Lond.), A.I.C., 8, Charnwood-street, Derby
1898	Trans.		Caven, Robert Martin, D.Sc. (Lond.), F.I.C., University College, Nottingham
1902			Challen, Matthew Bradbury, School of Mines, Daylesford, Victoria, Australia
1874			Chaloner, George, Combe House, Colyton, Axminster
1880			Chamberlain, Arthur Garratt, 3, Market-place, Rugby
1906			Chamberlain, Percy Garratt, M.A. (Cantab.), 3, Market-place, Rugby
1883			‖Chambres, Gordon Crewe, Rev., Grammar School, Wigan
1883			‖Chance, Alexander Macomb, J.P., c/o Messrs. Chance and Hunt, Ltd., Chemical and Cement Works, Oldbury, Birmingham
1902			‖Chance, Kenneth Macomb, M.A. (Cantab.), 14, Cornwall-terrace, Regent's Park, N.W.
1872			‖Chandler, Charles F., Prof., Ph.D., Columbia University, West 116th-street, New York City, U.S.A.
1889			‖Chaplin, Edward Mitchell, Ph.D. (Würzburg), F.I.C., Public Analyst's Office, Wakefield
1886	Trans.	C. 1908-	Chapman, Alfred Chaston, F.I.C., 8, Duke-street, Aldgate, E.C.
1895			Chapman, Arthur Jenner, F.I.C., Baronsmere, Stanhope avenue, Church-end, Finchley, N.
1898	Trans.		Chapman, David Leonard, B.A. (Oxon.), Jesus College, Oxford
1899	Trans.		Chapman, Edgar Marsh, F.I.C., Cairnsmore, Manor-road, Scarborough

Date of Election.			
1891			Charles, Rhys Pendrill, F.I.C., Bacteriological Laboratory, King's College, Strand, W.C.
1900			Chater, Arthur Brand, 65, Queen-street, Brisbane, Queensland
1894	Trans.	C. 1900-03	Chattaway, Frederick Daniel, M.A. (Oxon.), D.Sc. (Lond.), Ph.D. (Munich), Hon. B.Sc. (Birm.), F.R.S., F.I.C., 103, Woodstock-road, Oxford
1895			Cheadle, Walter William, M.A. (Oxon.), 36, London-road, Grays, Essex
1899			Cheater, Thomas John, B.Sc. (Lond.), 3, The Mansions, Star and Garter, Putney, S.W.
1900			Cheeseright, John Henry, B.Sc. (Lond.), 7, Claremont-place, Gateshead-on-Tyne
1887			Chenhall, James Warne, M.Inst.C.E., Dart-villas, Totnes, Devon
1908			Chew, John Henry, 46, Lytham-road, Blackpool
1897	Trans.		Chikashigé, Masumi, D.Sc. (Kyoto), College of Science and Engineering, Imperial University, Kyoto, Japan
1897			Cholerton, Alfred Foster, c/o Messrs. A. de St. Dalmas & Co., 40½, Belgrave-gate, Leicester
1891	Trans.		‖Chorley, John Christmas, Bewsey, Oxford-road, Birkdale, Lancs.
1907			‖Christie, John, B.A. (Cantab.), Eton College, Windsor
1874			Christopher, George, Walkden Works, Verney-road, Bermondsey, S.E.
1882			Chrystal, William James, F.I.C., 7, West George-street, Glasgow; and Shawfield Works, Rutherglen, near Glasgow
1906	Trans.		Chrystall, Edwin Rodney, B.Sc. (Lond.), A.I.C., Prospect House, Cliffe-at-Hoo, Kent
1856	Trans.	{C. 1876-80, 67-90}	‖Church, Arthur Herbert, Prof., M.A. and D.Sc. (Oxon.), F.R.S., F.I.C., Shelsley, Kew, Surrey
1903			Clacher, William, c/o Miss Cuthbert, 33, Upper Kelly-street, Greenock, N.B.
1888	Trans.		Claisen, Ludwig, Geh. Rath Prof., Ph.D. (Bonn), Augustastrasse 24, Godesberg-am-Rheim, Germany
1901	Trans.		Clark, Ernest, B.Sc. (Lond.), Royal Technical Institute, Salford; and 16, Havelock-street, Sheffield
1892			Clark, Ernest Victor, Woodlands, St. Anne's-crescent, Lewes
1905			Clark, Friend Ebenezer, Prof., B.Sc. (Virg.), Ph.D. (Johns Hopkins), The Central University of Kentucky, Dannville, Ky., U.S.A.
1905			Clark, Thomas Walter Firth, 11, Quadrant-road, Canonbury, N.
1909	Trans.		Clarke, George, Department of Agriculture, Cawnpore, U.P., India
1908	Trans.		‖Clarke, Hans Thacher, A.I.C., Gayton-corner, Harrow
1906	Trans.		Clarke, Reginald William Lane, F.I.C., 15, Torridon-road, Hither Green, S.E.

Date of Election.			
1905			Clarkson, George Douglas, King-street, Mirfield, Yorks.
1902			Claudet, Arthur Crozier, A.R.S.M., F.I.C., 6 and 7, Coleman-street, E.C.
1909	Trans.		Clayton, Arthur, B.Sc. (Lond.), 22, King's-road, Wimbledon, S.W.
1882	Proc.		Clayton, Edwy Godwin, F.I.C., 23, Holborn-viaduct, E.C.
1904			Clayton, Ellis, Hazeldene, Deerpark-road, Belfast
1893			Clayton, George, Northern College of Pharmacy, 100, Burlington-street, Manchester
1889			Clayton, John William, 3 and 5, Concert-street, Liverpool
1908			Clement, Leonard, B.A. (Cantab.), A.I.C., Beamsley, Fairhaven, near Lytham
1873	Trans.		Cleminshaw, Edward, M.A. (Oxon.), F.I.C., Alkali Works, Oldbury, near Birmingham
1875			Clerk, Dugald, F.R.S., 18, Southampton-buildings, Chancery-lane, W.C.
1902			Clifford, William, Sewage Outfall Works, Wolverhampton
1878			Cloud, Thomas Charles, A.R.S.M., F.I.C., Coronation House, 4, Lloyds-avenue, Fenchurch-street, E.C.
1907	Trans.		Clough, George William, B.Sc. (Birm.), 29, Oseney-crescent, N.W.
1902			Clough, William Thomas, A.R.C.S., Chelladene, St. Margaret's-road, Wanstead Park, Essex
1869	Trans.	{C. 1885-90, 99-03}	‖Clowes, Frank, Prof., D.Sc. (Lond.), F.I.C., The Grange, College-road, Dulwich, S.E.; and 40, Craven-street, Charing Cross, W.C.
1902			Clowes, George Henry Alexander, Ph.D. (Göttingen), Gratwick Research Laboratory, The University, Buffalo, U.S.A.
1897			Clutterbuck, Medwin Caspar, B.Sc. (Lond.), Ph.D. (Strassburg), 61, Beaconsfield-villas, Brighton
1905	Trans.		Coates, Joseph Edward, B.Sc. (Wales), Sunny Side, Oakamoor, Stoke-on-Trent
1887			Coates, William Henry, M.A., M.B. and L.S.A. (Dun.), M.R.C.S., L.R.C.P. and L.S.A. (Lond.), 7, Albion-street, Hull
1896			Cobb, Walter William, M.A. (Oxon.), Hilton House, Atherstone
1890			Cobbold, Paul Alexander, M.A. (Cantab.), Haileybury, Ontario, Canada
1895			Coblentz, Virgil, Prof., Ph.D. (Berlin), 115-119, W. 68th-street, New York City, U.S.A.
1880			‖Cockburn, Arthur Cecil, Longfield Broom-road, Hampton Wick, Middlesex
1906			Cockburn, Charles Taylor, 34, Queen's-gate, Dowanhill, Glasgow
1895	Trans.		Cockburn, George Bertram, B.A. and B.Sc. (Oxon.), The Ryelands, Taynton, Newcut, Gloucester

Date of Election.			
1901			Cockburn, Thomas, F.I.C., 148, Woodstock-avenue, Shawlands, Glasgow
1892			Cockerill, Thomas, Technical College, Colombo, Ceylon
1893			Cocking, Allan Thomas, Carhampton House, Four Oaks, Sutton Coldfield
1888			‖Cocking, Lewis Smith, Rashcliffe Dyewood Mills, Huddersfield
1902			Cockle, Charles, Seeburg, Hatherley-road, Winchester
1909	Trans.		Cocksedge, Herbert Edwin, B.A. and B.Sc. (Oxon.), 88, Chester-road, Castle Northwich, Northwich
1901			Coddington, Eustace, M.A. (Cantab.), 131, St. James's-road, Upper Tooting, S.W.
1903			Codling, Arthur John, 5, Tavistock-square, W.C.
1881			‖Coffin, Walter Harris, The National Liberal Club, Whitehall-place, S.W.
1885	Trans.	C. 1908-	Cohen, Julius Berend, Prof., Ph.D. (Munich), B.Sc. (Vict.), The University, Leeds
1901			‖Cohen, Robert Waley, M.A. (Cantab.), 11, Sussex-square, W.
1907			Colebourn, William Arthur, 24, Locket-road, Wealdstone, Middlesex
1891	Trans.		Colefax, Arthur, M.A. (Oxon.), Ph.D. (Strassburg), 4, Brick-court, Temple, E.C.
1883			Coleman, Joseph Bernard, F.I C., S.W. Polytechnic Institute, Manresa-road, Chelsea, S.W.
1909			Coles, Alfred Bertram, M.A. (Oxon.), 42, Broadwater-road, Tottenham, N.
1883			Collenette, Adolphus, Brooklyn, Fort-road, Guernsey
1908			Collens, Archibald Edgar, Government Laboratory, Port of Spain, Trinidad
1873			‖Collens, Edward, Stourbank House, Stourport, Worcs.
1905	Trans.		Colles, William Morris, jun., B.Sc. (Lond.), Chemical Laboratory, School of Medicine, Cairo, Egypt
1881			Collett, John Marton, Hillfield, Gloucester
1885	Trans.	C. 1889-94, 1900-1 V.P. 1909-	‖Collie, John Norman, Prof., Ph.D. (Würzburg), F.R.S., F.I.C., 16, Campden-grove, Kensington, W.
1908	Proc.		Collier, William Henry, 12, Oxford-gardens, Bayswater, W.
1897			Collingridge, Frank, B.Sc. (Lond.), F.I.C., 73, Fountain-road, Edgbaston, Birmingham
1892			‖Collins, Hugh Brown, B.Sc. (Glas.), Auchinbothie Estate Office, Kilmacolm, S.O., Renfrewshire, N.B.
1890			‖Collins, Sydney Hoare, M.Sc. (Dun.), F.I.C., Armstrong College of Science, Newcastle-on-Tyne
1888			Collins, Walter Hepworth, c/o Messrs. Edward Wihl & Co., 17, Nicholas-street, Manchester

Date of Election.		
1905		Collitt, Bernard, c/o Messrs. Rose and Laflamme, Ltd., 400, St. Paul-street, Montreal, Canada
1887	Trans.	‖Colman, Harold Govett, Ph.D. (Würzburg), M.Sc. (Vict.), F.I.C., Elmside, Worcester Park, Surrey
1890		Colwell, James Kear, F.I.C., Clerkenwell Town Hall, Rosebery-avenue, E.C.
1900		Comber, Albert Walter, F.I.C., Dinwaed, Victoria-avenue, Southend-on-Sea
1892		‖Comyns, Frank, M.A. (Oxon.), Bryum, Craven-road, Newbury, Berks.
1899		Connah, James, B.Sc. (Lond.), F.I.C., The Laboratory, Custom House, E.C.
1875		Connor, Charles Cunningham, B.A. (Q.U.I.), 4, Queen's-elms, Belfast
1883		‖Conrad, Edwin Charles, 24, Felbrigge-road, Seven Kings, Essex
1906		Conyngham, William Boulton, Otter Works, Manchester
1902		Cook, Arthur James, 167, Richmond-road, Hackney, N.E.
1875	Trans.	‖Cook, Ernest Henry, D.Sc. (Lond.), F.I.C., The Clifton Laboratory, 27, Berkeley-square, Clifton, Bristol
1895		Cook, Herbert William, B.Sc. (Lond.), The Technical Institute, Tunbridge Wells, Kent
1907		Cook, Taylor, B.Sc. (Lond.), A.R.C.S., 20, Studdridge-street, Parson's Green, S.W.
1890		Cooke, Arthur William, c/o Messrs. Brotherton and Co., Holmes-street, Dewsbury-road, Leeds
1909		Cooke, Reginald Cyril Herbert, 17, St. Edmund's-terrace, Regent's Park, N.W.
1888		Cooley, Walter Bromley, 5, Dudley-street, Wolverhampton
1909		Coope, John Charles Jesser, Union Club, Trafalgar-square, S.W.
1889		Cooper, Albert, 80, Gloucester-road, S. Kensington, S.W.
1898		‖Cooper, Albert John Bullen, 80, Gloucester-road, South Kensington, S.W.
1892		Cooper, Arthur James, B.A. (Dub.), B.Sc. (Lond.), F.I.C., Solihull School, Solihull, Birmingham
1888		Cooper, Astley, Stone, Greenhithe, Kent
1908		Cooper, Charles Duncan, The Laboratory, Manchester-chambers, Upper Parliament-street, Nottingham
1909		Cooper, George Stanley, Heaton House, Cleckheaton
1906		Cooper, Herbert Reginald, B.Sc. (Lond.), The Grammar School, Witney
1904		Cooper, Jabez Horace, B.A. (Oxon.), 13, Victoria-terrace, Exeter
1898		Cooper, John Burdon, M.D., B.S. and B.Sc. (Dun.), 22, The Circus, Bath

Date of Election		
1900		Cooper, William Francis, B.A. (Cantab.), 7, Grosvenor-road, Watford
1891		‖Cooper, Walter Johnson, The Elms, Lavernock, near Penarth
1894	Proc.	Coote, Arthur Herbert, B.Sc. (Lond.), Garwood, 36, Humber-road, Blackheath, S.E.
1899	Trans.	Cope, Frank, Swindon Villa, Dewsbury
1907		Copping, Hugh Hague, B.A. (Dub.), King's Hospital, Dublin
1890		‖Coppock, John Bridgeford, B.Sc. (Lond.), F.I.C., Lee-lane, Horsforth, Leeds
1891	Trans.	Corbett, Charles Henry, The Avenue, Trowbridge, Wilts.
1901	Trans.	Cormack, William, c/o Messrs. G. Nelson Dale & Co., Emscote Mills, Warwick
1888		‖Cornish, Vaughan, D.Sc. (Vict.), 157, Westbourne-grove, W.
1906		Cornwall, Reginald de Vere, Medical and Public Health Dept., Salisbury, Rhodesia, S. Africa
1890		Corrie, David, Nobel's Explosives Co., West Quarter Factory, Polmont Station, N.B.
1893	Trans.	Coste, John Henry, F.I.C., Utopia, Gloucester-road, Teddington, Middlesex
1909		Couch, David Little, 78, Westbury-road, Ilford
1892		‖Couldrey, Henry, c/o Messrs. Thos. Cook & Son, Ludgate-circus, E.C.
1905		Coupe, Miles, Rosebank, Thornfield-road, Waterfoot, near Manchester
1906	Trans.	Courtauld, Stephen Lewis, B.A. (Cantab.), 2, Friars-walk, Burton-on-Trent
1900		Courtman, Ernest Owen, Denford House, Atkins road, Clapham Park, S.W.
1903		‖Cousins, Francis George, 16, Old Elvet, Durham
1901	Trans.	Cousins, Herbert Henry, M.A. (Oxon.), Government Laboratory, Kingston, Jamaica
1885		Cousins, William James, F.I.C., 17, Temple-chambers, Temple-avenue, E.C.
1886	Trans.	‖Coutts, Francis James Henderson, M.D., B.Ch., B.Sc., and D.P.H. (Vict.), 48, Telford-avenue, Streatham Hill, S.W.
1909		Couzens, Edward Gordon, B.Sc. (Lond.), A.R.C.S., 47, Allfarthing-lane, Wandsworth, S.W.
1908		Coverdale, Arthur Edward, 68, Broad-street, Worcester
1907		Cowap, Matthewman Dalton, 15, Alexandra-road, St. John's Wood, N.W.
1906	Trans.	Coward, Hubert Frank, D.Sc. (Manc.), Hulme Hall, Victoria-park, Manchester
1898		Cowburn, Arthur William, 29, Princess-street, Manchester
1908		Cowburn, John Robert, 10, Eastwood-road, South Woodford, Essex

Date of Election.		
1882		‖Cowie, Thomas Rennie, Garnkirk House, Garnkirk, N.B.
1905		Cowie, William Beaverly, 26, East Claremont-street, Edinburgh
1908		Cowley, Robert Charles, College of Pharmacy, Brisbane, Queensland, Australia
1898		Cowling, Frederick, Technical Schools, Clay Cross, near Chesterfield
1905		Cowman, Douglas Henry Bellars, The English College, Jerusalem, Palestine
1904		Cowper, Alfred Denys, B.Sc. (Lond.), 121, Castellain-mansions, Maida Vale, W.
1888		Cowper, Joseph, 50, King-street, Penrith
1898		Cox, Frederick Hudson-, F.I.C., 67, St. Thomas'-street, Weymouth
1873		Cox, Samuel Herbert, 13, St. Helen's-place, E.C.
1904		Crabb, William, B.Sc. (Lond.), 5, Edridge-road, Croydon
1870	Trans.	Crafts, James Mason, Prof., 111, Commonwealth Avenue, Boston, Mass., U.S.A.
1892	Trans.	Craig, Andrew William, College of Pharmacy, 360, Swanston-street, Melbourne, Victoria
1897		Cranfield, William, The Higher Grade Board School, Halifax
1897		Creasey, Clarence Hamilton, 34, Palm-grove, Oxton, Birkenhead
1909		Creighton, Henry Jermain Maude, M.A. (Dalhousie), M.Sc. (Birm.), The University, Heidelberg, Germany
1909		Crewe, Philip Henry, c/o Messrs. Dakin Bros., Ltd., 82, Middlesex-street, E.
1887		‖Cribb, Cecil Howard, B.Sc. (Lond.), F.I.C., 136, Shaftesbury-avenue, W.
1878		‖Criper, William Risdon, A.R.S.M., F.I.C., Chemical Works, Konnagar, Calcutta, India
1907		Crisp, George Hugh, B.A. (Oxon.), 62, Gainsboro'-road, Crewe
1906		Crocker, Henry Ernest, 76, Church-road, Erdington, Birmingham
1902	Trans.	Crocker, James Codrington, M.A. (Cantab.), D.Sc. (Lond.), South Western Polytechnic, Manresa-road, Chelsea, S.W.
1901		Crocker, Walter Stevens, A.R.C.S., 39, Arnold-street, Princes Park, Liverpool
1897	Trans.	Crofts, James Murray, M.A. (Cantab.), B.Sc. (Lond.), 4, Brunswick-square, Gloucester
1907		Croghan, Edward Henry, Laboratory, Simmonds-street, Johannesburg, S. Africa
1886	Trans.	‖Crompton, Holland, Oaklyn, Cross Oak-road, Berkhamsted
1902		Crookes, Henry, 109, Ladbroke-grove, Notting Hill, W.
1901	Trans.	Crookes, Samuel Irwin, Marama-avenue, Owen's-road, Epsom, Auckland, New Zealand

Date of Election.			
1857	Trans.	C. 1866-70 V.P. 76-9, 85-7 P. 87-9	‖Crookes, Sir William, D.Sc. (Oxon., R.U.I., Cape of Good Hope), F.R.S., F.I.C., 7, Kensington Park-gardens, W.; and Athenæum Club, Pall Mall, S.W.
1879	Trans.	C. 1890-1, 93-5	‖Cross, Charles Frederick, B.Sc. (Lond.), F.I.C., 3, New-court, Carey-street, W.C.
1890	Trans.	C. 1901-2 S. 1905-	‖Crossley, Arthur William, Prof., D.Sc. (Vict.), Ph.D. (Würzburg), F.R.S., F.I.C., Pharmaceutical Society, 17, Bloomsbury-square, W.C.; and 10, Crediton-road, West Hampstead, N.W.
1896			Crossman, Charles Matthew, B.Sc. (Lond.), Cannon House, Watford, Herts.
1895			Crossman, Tom, 71, Waterworks-road, Oldham
1898			Crouch, William Samuel, Hersham, Walton-on-Thames
1880	Trans.		Crow, John Kent, D.Sc. (Lond.), F.I.C., Ivydene, Westcombe-park-road, Blackheath, S.E.
1887			‖Crowther, Horace Woodward, F.I.C., The Beeches, West Bromwich
1895			Croysdale, John, Whitley Bridge, S.O., Yorks.
1884			Crumbie, William Drake, 146, Washington-street, East Orange, N. J., U.S.A.
1887	Trans.		Cundall, James Tudor, B.Sc. (Lond.), F.I.C., Edinburgh Academy, Henderson-row, and 1, Dean-park-crescent, Edinburgh
1904			Cunningham, James Edward, Minas Peña del Hierro, Provincia del Huelva, Spain
1907			Cunningham, John Arthur, Prof., M.A. (Cantab.), B.A. (R.U.I.), A.R.C.S.I., The Observatory, Alipore, Calcutta; and Presidency College, Calcutta, India
1875			Curphey, William Salvador, F.I.C., 7, Derby-crescent, Kelvinside, Glasgow
1900			Cussons, John, B.Sc. (Vict.), High School, Aliwal North, Cape Colony, S. Africa
1881			‖Custance, John D., Prof., Broad View, Georgetown, S. Australia
1895			Cuthbertson, Lionel Mould Gurney, 89, Lordship Park, N.
1894			Dains, Herbert Henry, F.I.C., 27, Inderwick-road, Stroud Green, N.
1901	Trans.		Dakin, Henry Drysdale, D.Sc. (Vict.), F.I.C., 819, Madison-avenue, New York, U.S.A.
1907			Dall, Colin Ernest, B.Sc. (Lond.), Maisonette, Maybury-road, Woking, Surrey
1905			Dallman, Arthur Augustine, Lyndhurst, Prospect-vale, Liverpool
1904			Dalton, William Herbert, 85, Hayter-road, Brixton Hill, S.W.
1901	Trans.		Daniel, Gilbert Howard, B.Sc. (Lond.), 25, Church-walk, Ulverston

Date of Election.		
1887		Daniell, Louis Charles, Royal Standard Brewery, Tamworth, N.S.W.
1902		Daniels, James Ward, Westwood, Medomsley, S.O., Co. Durham
1892	Trans.	Darbishire, Francis Vernon, B.A. (Oxon.), Ph.D. (Leipzig), South Eastern Agricultural College, Wye, Kent
1852		Darby, Stephen, F.I.C., Cookham Dean, Berks.
1899		Darling, Charles Robert, A.R.C.S.I., F.I.C., Bryniach, Brent-road, Plumstead, Kent
1891		Darling, Thomas, Adderstone House, Berwick-on-Tweed
1871	Trans.	‖Darling, William Howarth, F.I.C., 26, Dover-street, Manchester
1875		‖Davey, G. William, 22, Tubbs-road, Harlesden, N.W.
1905		Davey, Joseph Morgan, Shelone House, Briton Ferry, Glam.
1897		Davidge, Henry Norris, 23, Rydal-road, Streatham, S.W.
1900		Davidson, Alexander, jun., F.I.C., 173, Colinton-road, Edinburgh
1906		Davidson, Charles, 65, Cadder-street, Pollokshields, Glasgow
1907		Davidson, Francis, c/o Messrs. Beverley Bros., Ltd., Eagle Brewery, Wakefield
1876		‖Davidson, Joseph, Green Bank, Holywell-green, Halifax
1898	Trans.	Davidson, William Brown, M.A. and D.Sc. (Aberd.), Ph.D. (Würzburg), F.I.C., Saltley Gas Works, Birmingham
1866	Trans.	‖Davies, Arthur Ellson, Ph.D., Tweedbank, West Savile-road, Edinburgh
1858	Trans.	Davies, Edward, The Laboratory, 28, Chapel-street, Liverpool
1905		Davies, John Llewelyn, M.A. (Cantab.), The Perse School, Cambridge
1896		Davies, Llewellyn John, Bute-chambers, Bute-road, Cardiff
1894		Davies, Samuel Henry, B.Sc. (Vict.), Rowntree's Cocoa Works, York
1900		Davis, Arthur Charles, 2, Downing-grove, Cambridge
1902		Davis, Charles Benson, c/o Dr. Francis Wyatt, S.W.-corner, 23rd-street and 9th-avenue, New York City, U.S.A.
1902		Davis, Frederick, B.Sc. (Vict.), Prospect House, Wiswell, near Whalley, Blackburn
1902		Davis, Henry Wilson, F.I.C., Farleigh, Crescent-road, Kingston Hill, S.W.
1857		‖Davis, J. Frederick, c/o J. Lewis, Esq., Government Laboratory, Parliament-street, Cape Town, S. Africa
1872	Trans.	‖Davis, Richard Hayton, 23, Regent-parade, Harrogate
1876		‖Davis, Walter Charles, The Chestnuts, Durdham Down, Bristol
1897	Trans.	Davis, William Alfred, B.Sc. (Lond.), 2, Ashgrove-road, Bromley, Kent
1900		Davison, Thomas Cuthbert, Bower-hill, Exmouth-street, Swindon

Date of Election.			
1906			Davson, Archibald Prideaux, A.R.C.S., A.I.C., 22, Chatsworth-gardens, Acton, W.
1900	Trans.		Dawson, Harry Medforth, D.Sc. (Leeds), B.Sc. (Lond.), Ph.D. (Giessen), The University, Leeds; and 25, St. Michael's-crescent, Headingley, Leeds
1890			Day, Charles Edwin, B.Sc. (Edin.), The Mines, Coniston, Lancs.
1881	Trans.		‖Day, Thomas Cuthbert, 36, Hillside-crescent, Edinburgh
1905			Day, William Walpole, B.Sc. (Wales), Llandilo, Attleborough-road, Nuneaton
1907			Dealy, Thomas Kirkman, Craigmin East, Magazine Gap, Hong Kong, China
1901	Trans.		Dean, George, M.A. (Cantab.),38, Brisbane-road, Ilford, E.
1904			Deane, Harold, B.Sc. (Lond.), F.I.C., St. Olave's, Sudbury, Suffolk
1886			Deane, Leopold Mandeville, 21, Station-terrace, Abbey Village, near Chorley, Lancs.
1859		V.P. 1871-4	Debus, Heinrich, Prof., Ph.D. (Marburg), F.R.S., Schlangenweg 4, Cassel, Provinz Hessen, Germany
1898	Trans.		‖De Castro, John Paul, M.A. (Cantab.), F.I.C., 1, Essex-court, Temple, E.C.
1885	Trans.		Dechan, Martin, F.I.C., Laboratory of Public Analyst, Hawick
1903			Deeks, William Thomas, High-street, Shanklin, Isle of Wight
1869	Trans.		‖Deering, William Henry, I.S.O., F.I.C., 3, Broad-park-avenue, Ilfracombe
1900	Proc.		Deerr, Noël Fielding, Experiment Station, Hawaian Sugar Planters' Association, Honolulu, H.I., U.S.A.
1902			De la Rue, Evelyn Andros, B.A. (Oxon.), 110, Bunhill-row, E.C.
1905			De Lury, Ralph Emerson, M.A. and Ph.D. (Toronto), The Dominion Astronomical Observatory, Ottawa, Canada
1907	Trans.		Denham, William Smith, B.Sc. (Lond.), F.I.C., The United College, St. Andrews
1892			Denison, Joseph Richard, c/o Messrs. Denison, Preussner & Co., Valley Dyeworks, Bradford
1902			Dennis, William, High-street, Mundesley-on-Sea, S.O., Norfolk
1906			Denton, John, Crossley Hall, Bradford
1903	Trans.		Desch, Cecil Henry, D.Sc. (Lond.), Ph.D. (Würzburg), F.I.C., Metallurgical Laboratory, The University, Glasgow
1897			‖Deverell, Louis Charles, Brantwood, Shortlands-grove, Shortlands, Bromley, Kent
1870	Trans.	C. 1874-7 V.P. 80-3 86-8, 96-7 P. 97-9	‖Dewar, Sir James, Prof., M.A. (Cantab.), Hon. LL.D. (St. Andrews, Aberd., Edin., Glas.), Hon. D.Sc. (Oxon., Dub., Vict., Ireland), F.R.S., F.I.C., Royal Institution, Albemarle-street, W.

Date of Election.			
1899			Dewhirst, John Arthur, F.I.C., 13, Highfield-terrace, Nab Wood, Saltaire, Bradford
1880			Dibdin, William Joseph, F.I.C., Purley Bury, Purley-downs-road, Sanderstead, Croydon
1872			‖Dickinson, Arthur John, F.I.C., Truro Villa, 57, Lewisham-high-road, S.E.
1908	Trans.		Dickinson, Cyril, B.Sc. (Vict. and Leeds), F.I.C., Southwark Town Hall, Walworth-road, S.E.
1898			Dickson, Samuel, Chemical Laboratory, 2, Broadway, Westminster, S.W.
1906			Dickson, William, Branksome, Bridge-of-Weir, N.B.
1907			Dikshit, Mohan Nath Kedarnath, Amliran, Surat, India
1906			Dinwoodie, James Herbert, 71, Bree-street, Johannesburg, S. Africa
1860	Trans.	C.1873-4 V P. 1900-03	‖Divers, Edward, Prof., M.D. and Hon. D.Sc. (R.U.I.), F.R.S., F.I.C., 3, Canning-place, Palace Gate, W.
1897			Dixon, Andrew James, F.I.C., 97, Pitt-street, Sydney, N.S.W.
1885	Trans.	C. 1900-06	Dixon, Augustus Edward, Prof., M.D. (Dub.), Queen's College, and Fernhurst-avenue, Western-road, Cork
1896	Trans.		Dixon, Frank, B.Sc. (Lond.), The Institute, Lydney, Gloucester
1894	Proc.		‖Dixon, George, Major, M.A. (Cantab.), Trinity College, Cambridge; and St. Bees, S.O., Cumberland
1876	Trans.	C.1892-6 V.P. 1904-7 P.1909-	‖Dixon, Harold Baily, Prof., M.A. (Oxon.), F.R.S., The University, Manchester
1893			Dixon, Harry William, 32, Grange-view, Chapeltown-road, Leeds
1895			Dixon, William, 102, Spring-street, Bury
1862			Dixon, William Adam, F.I.C., 97, Pitt-street, Sydney, N.S.W.
1882	Trans.	C.1901-6 V.P. 1907-	Dobbie, James Johnston, Prof., M.A. (Glas.), D.Sc. (Edin.), F.R.S., F.I.C., Museum of Science and Art, Edinburgh
1887	Trans.		Dobbin, Leonard, Ph.D. (Würzburg), F.I.C., Chemical Laboratory, New University-buildings, Edinburgh
1898			‖Dodd, Frederick Robertson, F.I.C., Welbank-villas, Liverpool-road, Aughton, Ormskirk
1901			Dodd, Robert, 56, Valley-road, Streatham, S.W.
1886			Dodd, W. Ralph, Trederwen, Village-road, Enfield, Middlesex
1892			Dodds, George Price, 14, St. Luke's-terrace, Darlington
1905			Dodds, Roger, Kingswood School, Bath
1897	Proc.		Dodgson, John Wallis, B.Sc. (Lond.), University College, Reading
1894	Proc.		Doherty, William Michael, F.I.C., Government Laboratory, Sydney, N.S.W.
1905			Donald, Robert, M.A. and B.Sc. (N.Z.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), D.P.H. (Oxon.), Mental Hospital, Orokonui Home, Waitati, New Zealand

Date of Election.		
1892		Donaldson, Hudson, The Laurels, St. Catharine's - road, Grantham
1901	Trans.	Donnan, Frederick George, Prof., M.A. (R.U.I.), Ph.D. (Leipzig), Muspratt Laboratory, The University, Liverpool
1897	Trans.	Dootson, Frederick William, M.A. (Cantab.), D.Sc. (Dub.), F.I.C., University Chemical Laboratory, Cambridge
1902	Trans.	Dorée, Charles, M.A. (Oxon.), D.Sc. (Lond.), 58, Gore-road, N.E.
1899		Dougall, James Dick, Senhouse-street, Maryport, Cumberland
1888		‖Douglas, William, F.I.C., Diamond, Demerara, British Guiana
1905		Doull, John, 22, Lauriston-place, Edinburgh
1884		Down, Frederick Johnathan, Glengariff, Milton-road, Harpenden, Herts.
1899		Doyle, Frederick, Oakdene, Scotland-road, Slanwix, Carlisle
1884		Draper, Henry Carter, St. Kevin's, Sorrento-road, Dalkey, Co. Dublin
1891	Proc.	Dreaper, William Porter, F.I.C., 68, Victoria-street, S.W.
1893		Dreyfus, Charles, Ph.D., The Clayton Aniline Co., Clayton, Manchester
1906		Drinkwater, Lionel John, Burford, Oxon.
1902		Drought, James Justinian, Molo, *viâ* Mombasa, British East Africa
1895		Druce, Edric, County Agricultural Institute, Ridgmont, Aspley Guise, S.O., Beds.
1904	Trans.	Drugman, Julien, Ph.D. (Bonn), 117, Rue Gachard, Brussels, Belgium
1897		Duckham, Alexander, Phœnix Wharf, West Ferry-road, Millwall, E.
1908		Duckworth, Hugh Cecil, Elmstead, Twickenham
1907		Duckworth, Samuel, M.Sc. (Vict.), 81, Regent-road, Salford, Manchester
1901		Duckworth, William Henry, Weaste House, Borough-road, Salford
1899		Dudderidge, Frank Rawlinson, Brecknock House, Blandford
1898		Dudley, Charles Benjamin, Ph.D. (Yale), Drawer 334, Altoona, Pa., U.S.A.
1890		‖Dudley, William Lofland, Prof., Vanderbilt University, Nashville, Tenn., U.S.A.
1892		Duffield, Walter William, 5, Ashington-road, Hurlingham, Fulham, S.W.
1893	Trans.	‖Dufton, Samuel Felix, M.A. (Cantab.), D.Sc. (Lond.), Laurel Bank, Claremont-road, Headingley, Leeds
1884		Duggan, Thomas Richard, F.I.C., 60, Foyle-road, Blackheath, S.E.
1889		Duisberg, Carl, Prof., Ph.D., Elberfeld, Germany
1889		‖Dukes, Thomas William, P.O. Box 10, Vryheid, S. Africa

Date of Election.			
1881			Duncan, Arthur William, c/o Messrs. Jas. Woolley, Sons & Co., Ltd., Victoria Bridge, Manchester
1894	Proc.		‖Duncan, Cecil Cooke, F.I.C., The Shire Hall, Worcester
1906			Duncan, Robert Kennedy, Prof., University of Kansas, Lawrence, Kansas, U.S.A.
1891			Duncan, William, F.I.C., The Laboratory, 65, Bath-row, Edgbaston, Birmingham
1896			Duncan, William, Royal Dispensary, 21, West Richmond-street, Edinburgh
1905			Dunlop, Harry, c/o Messrs. R. R. Tatlock and R. T. Thomson, 156, Bath-street, Glasgow
1909	Trans.		‖Dunlop, John Gunning Moore, Caius College, Cambridge
1894	Proc.		‖Dunn, Frederic, 193, Collins-street, Melbourne, Australia
1909	Trans.		Dunn, Frederick Percy, B.Sc. (Lond.), Haresfield, Chorley Wood, Rickmansworth, Herts.
1882			Dunn, John Thomas, D.Sc. (Dun.), F.I.C., 10, Dean-street, Newcastle-on-Tyne
1908			Dunnicliff, Horace Barratt, B.A. (Cantab.), B.Sc. (Lond.), Mohammedan Anglo-Oriental College, Aligarh, United Provinces, India
1893			Dunnington, Francis Perry, University of Virginia, Charlottesville, U.S.A.
1899			Dunscombe, Frederick Charles, c/o Electric Reduction Co., Buckingham, Quebec, Canada
1901	Trans.		Dunstan, Albert Ernest, B.Sc. (Lond.), East Ham Technical College, East Ham, E.
1885			Dunstan, Malcolm James Rowley, M.A. (Oxon.), F.I.C., The College, Wye, Kent
1905			Dunstan, Sydney, The Royal Infirmary, Newcastle-on-Tyne
1879	Trans.	C. 1888-91 S. 93-1903 V.P. 1903-06	‖Dunstan, Wyndham Rowland, Prof., Hon. M.A. (Oxon.), Hon. LL.D. (Aberd.), F.R.S., F.I.C., Imperial Institute, S.W.
1907			Dupré, Frederick Harold, St. Maur, Benhill Wood-road, Sutton, Surrey
1907			Dupré, Percy Vivian, A.C.G.I., F.I.C., St. Maur, Benhill Wood-road, Sutton, Surrey
1871			‖Durham, Henry, 13, Coleherne-road, South Kensington, S.W.
1906			Durrans, Thomas Harold, B.Sc. (Lond.), 1, Cornwall-terrace, Regent's Park, N.W.
1883	Trans.		Durrant, Reginald Graham, M.A. (Oxon.), The College, Marlborough, Wilts.
1908			Dutt, Bidhu Bhushan, Prof., M.A. (Calcutta), Presidency College, Calcutta, India

Date of Election.			
1907			Dutton, Francis Bridger, Birch Hall, Windlesham, Camberley
1892			Duxbury, Thomas, 17, Grosvenor-chambers, Deansgate, Manchester
1909			Dyche-Teague, Francis Clifford, B.Sc. (Birm.), 8, Mount-road, Hendon, N.W.
1875	Trans.	C 1893-7 1904-08	‖Dyer, Bernard, D.Sc. (Lond.), F.I.C., 17, Great Tower-street, E.C.
1890	Trans.		Dymond, Thomas Southall, F.I.C., Board of Education, South Kensington, S.W.
1883	Trans.		‖Dyson, Septimus, 44, Fairmile-avenue, Streatham, S.W.
1905			Eade, Samuel George, Farndish Rectory, Wellingborough
1908	Trans.		Eagles, Edwin Mortimer, M.A. (Cantab.), The Grammar School, Enfield, Middlesex
1876			‖Earp, Francis Salsbury, Ph.D. (Giessen), F.I.C., 35, Porter-street, Kalgoorlie, W. Australia
1907			Eastaugh, Frederick Alldis, A.R.S.M., The University, Sydney, N.S.W.
1889	Trans.		‖Easterfield, Thomas Hill, Prof., M.A. (Cantab.), Ph.D. (Würzburg), F.I.C., Victoria University College, Wellington, New Zealand
1891			Eastick, Charles E., Martineau's Refinery, King Edward-street, Whitechapel, E.
1881			Eastick, John Joseph, A.R.S.M., F.I.C., Ashburton, Northfield-road, Stamford Hill, N.
1908			Easton, Reginald Freeman, 38, Edith-road, West Kensington, W.
1903			Eastwood, Arthur William, B.A. (Cantab.), Newton College, Newton Abbot
1906			Eaton, Bertie James, A.I.C., Institute of Medical Research, Kuala Lumpur, Selangor, Federated Malay States
1878	Trans.		‖Eccles, Herbert, Briton Ferry Steel Works, Briton Ferry, Glamorganshire
1909			‖Edge, John Harold, Great Marld, Smithills, Bolton
1906			Edgell, Cecil Wyatt-, B.A. (Oxon.), Cowrey-place, Exeter
1903	Proc.		Edgerton, John Percy, St. Lawrence House, 96, Cheapside, E.C.
1902			Edlin, Edgar Leeder, B.A. (Oxon.), 31, All Saints-road, Leicester
1902			Edminson, Sidney Robert, B.Sc. (Lond.), Maritzburg College, Natal, S. Africa
1893			Edwards, Thomas, Ty Mawr, Rhymney, viâ Cardiff
1884			Edwards, Vincent, F.I.C., c/o Lawes' Chemical Manure Co., Barking Creek, Essex
1892			Edwards, Walter Nicholas, 6, Shardcroft-avenue, Herne Hill, S.E.
1898			‖Edwards, Wilbraham Tollemache Arthur, M.R.A.C., F.I.C The Laboratory, Phœnix, Mauritius

Date of Election.		
1909	Trans.	Egerton, Alfred Charles Glyn, B.Sc. (Lond.), Chilton House, Thame
1887		‖Ehrhardt, Ernest Francis, D.Sc. (Lond.), Ph.D. (Munich), B.Sc. (Birm.), Badische Anilin und Soda Fabrik, Ludwigshafen-am-Rheim, Germany
1899		Eichenauer, William Frederick, 18, Maryon-road, Old Charlton, Kent
1883		‖Ekins, Arthur Edward, J.P., F.I.C., Rushden, Lattimore-road, St. Albans
1903		Elford, Archibald Sefton, M.A. (Oxon.), 41, Broomfield-road, Chelmsford
1891		Elford, Percy, M.A. (Oxon.), 115, Woodstock-road, Oxford
1907		Elias, Owen Aubrey, 123, Waller-road, New Cross, S.E.
1878	Trans.	‖Elliott, Arthur H., Ph.D., c/o Consolidated Gas Co., 4, Irving-place, New York City, U.S.A.
1896	Trans.	Elliott, Walter John, M.A. (Cantab.), Woodcroft, Lichfield-road, Stafford
1893		Ellis, Charles Sordes, F.I.C., Meadowlead, Station-road, Harrow
1900		Ellis, Frederic Richard, 146, Ashley Down-road, Bristol
1903	Proc.	Ellis, Henry Russel, B.Sc. (Lond.), 179, Warwick-road, Kensington, W.
1878		Ellis, William Hodgson, Prof., M.A. (Cantab.), M.B. (Toronto), F.I.C., School of Practical Science, Toronto, Canada
1892		Ellison, Henry, jun., Whitechapel-road, Cleckheaton
1893		Elmore, Alexander Stanley, 72, Gloucester-terrace, Hyde Park, W.
1902		Elsden, Alfred Vincent, B.Sc. (Lond.), F.I.C., Chemical Department, Royal Arsenal, Woolwich, S.E.
1885		Embrey, George, F.I.C., City and County Laboratory, 47, Park-road, Gloucester
1887		‖Emmons, Hamilton, The Copse, Hamble, Southampton
1901		English, Robert, Christchurch Gas Co., Christchurch, New Zealand
1892		Entwistle, Herbert, 1, Albert-place, Dickenson-road, Longsight, Manchester
1899		Epps, James Washington, 159, King's-avenue, Clapham Park, S.W.
1889		Erskine, James Kerr, New Kleinfontein Co., Ltd., Post Office, Benoni, Transvaal, S. Africa
1883	Trans.	Esilman, Alexander, Fleetwood Lodge, 25, Roe-lane, Southport
1909		Essex, Harry, jun., 23, Bescot-street, Walsall
1862		‖Esson, William, Prof., M.A. (Oxon.), F.R.S., Merton College, Oxford
1865		‖Estcourt, Charles, F.I.C., Seymour House, Seymour-grove, Old Trafford, Manchester

Date of Election.		
1899		‖Estcourt, Harry Estcourt, 467, West-street, Durban, Natal, S. Africa
1888		‖Estcourt, Philip Anderson, F.I.C., Seymour House, Seymour-grove, Old Trafford, Manchester
1894		Eumorfopoulos, Nicholas, B.Sc. (Lond.), 33, Gloucester-square, Hyde Park, W.
1905		Evans, Bernard Scott, B.Sc. (Lond.), A.I.C., 42, Keymer-road, Streatham, S.W.
1904		Evans, Edward, The Laboratory, South Metropolitan Gas Co., 709, Old Kent-road, S.E.
1891		Evans, Frederick Arthur, The Cape Copper Co., Ookiep, Namaqualand, Cape of Good Hope, S. Africa
1906		Evans, Frederick Watkins, 11, High-street, Cardigan
1904		Evans, John, F.I.C., 67, Surrey-street, Sheffield
1904		Evans, Nevil Norton, McGill University, Montreal, Canada
1892	Trans.	‖Evans, Robert Cecil Turle, M.B. and B.S. (Lond.), M.R.C.S. (Eng.), L.R.C.P., L.S.A., D.P.H. and B.Sc. (Lond.), Sandringham House, Marine-crescent, Herne Bay, Kent
1888		‖Everard, Arthur George, 43, Clapham-road, S.W.
1908		Everitt, Charles, M.A. (Oxon.), 67, Boston-Avenue, Southend-on-Sea
1902		Everitt, Walter, Norwood Wharf, Southall, Middlesex
1894		Evershed, Frank, Kenley, Surrey
1896	Trans.	Ewan, Thomas, M.Sc. (Vict.), Ph.D. (Munich), c/o Cassel Cyanide Co., Ltd., Shuna-street, Maryhill, Glasgow
1902	Trans.	Eynon, Lewis, B.Sc. (Lond.), F.I.C., 57, Darenth-road, Stamford Hill, N.
1901	Trans.	Eyre, John Vargas, Ph.D. (Leipzig), 26, Bridge-road-west, Battersea Park, S.W.

1888		Faber, Harald Nicolai, 7 and 8, Idol-lane, E.C.
1904		Fagan, Thomas Wallace, M.A. (Cantab.), Edinburgh and East of Scotland College of Agriculture, 13, George-square, Edinburgh
1908		Fairburn, Henry, Eastholme, Northallerton
1903		Fairhall, Edwin Jesse, A.C.G.I., A.I.C., 96, Blackstock-road, Finsbury Park, N.
1865	Trans.	‖Fairley, Thomas, F.I.C., 17, East-parade, Leeds
1895		Fairrie, Henry, 253, Vauxhall-road, Liverpool
1899		Fairweather, Ernest Barratt, King's College Hospital, Lincoln's Inn Fields, W.C.
1908		Fairweather, James Hill, 62, Wythes-road, Silvertown, E.
1908		Falk, Kaufman George, B.Sc. (Columbia), Ph.D. (Strassburg), Carlton Hotel, Boston, U.S.A.

Date of Election.			
1888			Farlie, John Burke, 54, Wellington-road, Old Charlton, Kent
1906			Farmer, Charles George Edgar, 16, Herbert-crescent, S.W.
1907			Farmer, John Edwin, Blelsoe, New-road, Mitcham Junction, Surrey
1903	Trans.		Farmer, Robert Crosbie, D.Sc. (Vict.), Ph.D. (Würzburg), St. Katherine's, Southwood-road, New Eltham, Kent
1895			Farr, Edward Henry, Uckfield, Sussex
1870			‖Farries, Thomas, F.I.C., 16, Coleman-street, E.C.
1880			‖Farrington, Thomas, M.A. (Q.U.I.), F.I.C., 5, Summerhill-terrace, Wellington-road, Cork
1907			Fawcitt, Claude Scott, 11, St. Mark's-road, Bangalore, India
1887			Fawsitt, Charles Albert, 9, Foremount-terrace, Dowanhill, Glasgow
1903	Trans.		Fawsitt, Charles Edward, Prof., D.Sc. (Edin.), Ph.D. (Leipzig), The University, Sydney, N.S.W.
1906	Proc.		Feilmann, Martin Ernest, B.Sc. (Lond.), Ph.D. (Bâle), F.I.C., 92, Victoria-street, S.W.
1897			Fenby, Alarick Vincent Colpoys, B.Sc. (Lond.), Windsor-villas, Penwortham, Preston
1878	Trans.	{C. 1898-1902}	‖Fenton, Henry John Horstman, M.A. and Sc.D. (Cantab.), F.R.S., F.I.C., Christ's College, and 19, Brookside, Cambridge
1898			Ferguson, James Edward, Laboratory and Assay Office, 2, Union-court, Old Broad-street, E.C.
1872		C. 1889-93	‖Ferguson, John, Prof., M.A. (Glas.), LL.D. (St. Andrews), F.I.C., The University, Glasgow
1901			Ferguson, Reginald Williams, B.Sc. (Lond.), A.R.C.S., 57, Linden-road, Bournville, Birmingham
1899			Fermor, Herbert Frederick Francis Burdett, 32, Trossacks-road, East Dulwich, S.E.
1909	Trans.		‖Ferraboschi, Frederic, B.A. (Cantab.), Clare College, Cambridge
1902			Ferrand, Frederick, 13, Torrington-street, Hopwood, Heywood
1882			Ferrier, James, P.O. Box 764, Rome, Georgia, U.S.A.
1905			Ferrier, John Greig, 6, Brunswick-square, Port of Spain, Trinidad, West Indies
1902			Ferrier, John Oliver, c/o Compagnie Française des Phosphates de l'Océanie, Papeete, Tahiti
1902			Ferris, Percy James, Gorse Bank, Thursaston-road, Heswall, Cheshire
1906			Field, Samuel, A.R.C.S., Northampton Polytechnic Institute, Clerkenwell, E.C.
1904			Field, William Eddington, Martin-street, Elsternwick, Melbourne, Australia
1895			Fielding, Patrick Joseph Dominick, 66, Patrick-street, Cork
1906	Trans.		Fierz, Hans Eduard, Ph.D. (Zürich), Farben-Extractfabriken, vorm J. R. Geigy, Bâle, Switzerland

Date of Election.			
1900	Trans.		Findlay, Alexander, M.A. and D.Sc. (Aberd.), Ph.D. (Leipzig), The University, Birmingham
1908			Findley, Albert Edward, B.Sc. (Birm.), 1, Welford-road, Handsworth, Birmingham
1905			Findon, Frank Standish, Rev., M.A. and B.Sc. (St. Andrews), 41, Great Percy-street, Holford-square, W.C.
1904			Finlow, Robert Steel, B.Sc. (Wales), c/o Messrs. Grindlay and Co., Calcutta, India
1905	Trans.		Finnemore, Horace, B.Sc. (Lond.), F.I.C., High Leasow, Coulsdon, S.O., Surrey
1907			Fischer, Eugen, Ph.D. (Zürich), c/o Messrs. Kalle & Co. Aktiengesellschaft, Biebrich-am-Rheim, Germany
1896			Fisher, Ernest Hunter, The County Laboratory, St. Albans
1872	Trans.		‖Fisher, Walter William, M.A. (Oxon.), F.I.C., 5, St. Margaret's-road, Oxford
1873			Fison, Edward Herbert, Stoke House, Ipswich
1872			Fison, Sir Frederick William, Bart., M.A. (Oxon.), 64, Pont-street, S.W.
1906			Fitzgerald, Anthony Nisbet, B.A. and B.Sc. (Lond.), 12, St. Mary's-road, Strood, Rochester
1900			FitzGibbon, Thomas, 115, Harbord-street, Fulham, S.W.
1896			Fleet, John Thomas, 24, Sheep-street, Rugby
1899	Trans.		‖Fleischmann, Friedrich Noël Ashcroft, M.A. (Oxon.), 37, Palace-court, Bayswater, W.
1898			‖Fleming, John Arnold, Britannia Pottery, 136, Glebe-street, Glasgow
1874			Fletcher, Frederick William, North London Chemical Works, Holloway, N.; and Beauchamp Lodge, Enfield
1885		C. 1893-4	‖Fletcher, Lazarus, M.A. (Oxon.), F.R.S., Natural History Department, British Museum, Cromwell-road, S.W.; and 35, Woodville-gardens, Ealing, W.
1894			‖Flintoff, Robert John, Haxby, York
1892			Floris, Robert Brooke, F.I.C., Church House, West Hanningfield, near Chelmsford
1906	Trans.		Flürscheim, Bernhard, Ph.D. (Heidelberg), Rushmoor, Fleet, Hants.
1894			Fogg, Charles Albert, Graythorne, Albert-road, Bolton
1859			Fogg, Thomas, 93, Portsdown-road, Maida Vale, W.
1889			Foggie, John, University College, Dundee
1902			Foll, Edgar, The Cottage, The Lion Brewery, Belvedere-road, Lambeth, S.E.
1885			Follows, Harold, 4, Kensington-avenue, Victoria-park, Manchester
1894			‖Forbes, Donald Gordon, Shillingstone, Blandford

Date of Election.			
1874			Forbes, James, St. Kitts, Bexhill-on-Sea
1889	Trans.		Ford, John Simpson, c/o Messrs. W. Younger and Co., Abbey Brewery, Edinburgh
1907			Foreman, Charles Thomas, Jamalpur, East Indian Railway, Bengal, India
1886			Formoy, James Arthur, Chestham, Grange-road, Sutton, Surrey
1904			Forrest, John Kerr, Hawsleigh, Balaclava-road, St. Kilda, Victoria, N.S.W.
1893			Forrester, Alexander Machattie, c/o Messrs. Laidlaw, MacKill and Co., Ltd., 3400, Williamsburg-avenue, Richmond, Va., U.S.A.
1905			Forster, Ernest Lyle Carman, M.A. (Toronto), 317, Queen-street, Ottawa, Canada
1892	Trans.	C. 1901-04. S. 1904-	‖Forster, Martin Onslow, D.Sc. (Lond.), Ph.D. (Würzburg), F.R.S., F.I.C., Royal College of Science, South Kensington, S.W. ; and 84, Cornwall-gardens, South Kensington, S.W.
1903			Forster, William, 30, Church-street, Seaham Harbour
1856	Trans.	C. 1865-8, 72-5, 85-6. V.P. 88-92.	‖Foster, George Carey, Prof., B.A. (Lond.), LL.D. (Glas.), D.Sc. (Vict.), F.R.S., Emeritus Professor of Physics, University College, Gower-street, W.C. ; and Ladywalk, Rickmansworth, Herts.
1872			Foster, Reginald Le Neve, Bollindene, Wilmslow, Cheshire
1906			Foucar, James Louis, B.Sc. (Lond.), 20, St. John's-park, Blackheath, S.E.
1900			Foulds, James, A.R.C.S., 21, Pearson-street, Darwen
1898			Foulerton, Alexander Grant Russell, F.R.C.S. (Eng.), L.R.C.P., (Lond.), D.P.H. (Cantab.), Haywards Heath, Sussex
1891	Trans.		‖Fowler, Gilbert John, D.Sc. (Vict.), F.I.C., Broad Oak, Urmston, Manchester
1900			Fowler, Morris Broad, 19, Westbury-road, Westbury-on-Trym, near Bristol
1882			‖Fowler, William, 1, Grace-terrace, Sunderland
1909			Fowler, William, 3, Cranbrook-road, Victoria Docks, E.
1907			Fowles, George, 28, Weltje-road, Hammersmith, W.
1895			Fox, Albert Stanley, Greycote, Westcliff, Herne Bay, Kent
1907	Trans.		Fox, John Jacob, B.Sc. (Lond.), 6, Alkham-road, Stamford Hill, N.
1909			Fox, John Thomas, Glen Burn, Stollard-street, Clay Cross, Chesterfield
1907			Foxell, Edward William Lanchester, B.Sc. (Lond.), Barnes, Christ's Hospital, West Horsham, Sussex
1906			Foye, Peter Bertram, 16, Burlington-road, Dublin
1908			Francies, Joseph Valentine, Durham House, Westoe-road, South Shields

Date of Election.			
1909			Francis, Arthur Gordon, B.Sc. (Lond.), F.I.C., 50, Whitbread-road, Brockley, S.E.
1879			Francis, Edward, Clifton-lane, Ruddington, Nottingham
1902	Trans.		Francis, Francis Ernest, Prof., Ph.D. (Erlangen), D.Sc. (Vict.), F.I.C., University College, Bristol
1873			‖Francis, George Bult, 21, Taviton-street, Gordon-square, W.C.
1881			Frankland, Henry, F.I.C., Streonshalh, The Crescent, Linthorpe, Middlesbro'.
1880	Trans.	C. 1887-9 V.P. 1902-05.	‖Frankland, Percy Faraday, Prof., Hon. LL.D. (St. Andrews), Ph.D. (Würzburg), Hon. M.Sc. (Birm.), B.Sc. (Lond.), A.R.S.M., F.R.S., F.I.C., The University, Birmingham
1867			‖Fraser, Angus, M.A. and LL.D. (Aberd.), M.D., C.M. (Aberd. and Paris), 232, Union-street, Aberdeen
1892			‖Fraser, James Christopher, Austin-street, Adelaide, S. Australia
1885			Freear, Harry Marshall, Hardwick-road, Woburn Sands, Beds.
1887			Freeman, Frederick William, Heatherdale, Spenser-road, Harpenden, Herts.
1900			Freeman, Willie Ludford, M.A. (Oxon. and Dub.), LL.D. (Dub.), 9, Hamilton-avenue, Chapeltown-road, Leeds
1889			Freestone, Joseph Thomas, Limehurst, Plymyard-avenue, Bromboro', Cheshire
1892	Proc.		French, William, M.A. (Cantab.), F.I.C., Storey Institute, Lancaster
1903	Trans.		Friend, John Albert Newton, M.Sc. (Birm.), Ph.D. (Würzburg), Technical College, Darlington
1890			‖Frost, Robert, B.Sc. (Lond. and Vict.), 55, Kensington-court, Kensington, W.
1904			‖Fry, George, Carlin Brae, Berwick-on-Tweed
1899	Trans.		Frye, Colin Charlwood, 11, King's-avenue, Ealing, W.
1880			‖Fryer, Alfred Cooper, M.A. and Ph.D. (Leipzig), F.I.C., 13, Eaton-crescent, Clifton, Bristol
1907			Fryer, Percival John, 27, Minster-road, Cricklewood, N.W.
1891			Fulcher, Lionel William, B.Sc. (Lond.), Victoria and Albert Museum, S.W.; and Ingleside, 37, Kempshott-road, Streatham Common, S.W.
1896			Fuller, Charles James Pemeller, 603, Chorley-new-road, Horwich, near Bolton, Lancs.
1909			Furnell, John Thomas, 32, Grosvenor-park-road, Walthamstow, N.E.
1894			‖Gabb, George Hugh, 83, Crayford-road, Tufnell-park, N.
1899			Gabriel, Edmund Vivian, M.A. (Cantab.), C.V.O., The Pines, Southern-road, Southbourne, Christchurch
1901			Gadd, Henry Wippell, Barrister-at-Law, Common Room, Middle Temple, E.C.; and 27, East Southernhey, Exeter

Date of Election.		
1901		Gajjar, Tribhuvandas Kalyandas, Prof., M.A. and B.Sc. (Bombay), Gingaum, Bombay, India
1908		Gale, Robert Cecil, A.C.G.I., 13, Ellys-road, Coventry
1905		Gall, John Beaconsfield, A.C.G.I., F.I.C., 7, Linden-grove, Nunhead, S.E.
1903		Gandy, William Hunter, Bradley Court, Mitcheldean, Gloucester
1908	Trans.	Ganguli, Atul Chandra, Prof., B.A. (Calcutta), Ravenshaw College, Cuttack, Orissa, India
1883	Proc.	‖Garbutt, Llewellyn, M.A. (Cantab.), The College, Winchester
1903		Gardiner, Ernest Alexander, M.A. (Oxon.), The College, Plymouth
1888		Gardiner, James Henry, 59, Wroughton-road, Balham, S.W.
1905		Gardner, Charles Richard, Chemical Laboratory, Gathurst, near Wigan
1906		Gardner, Edward, 70, Parliament-hill-mansions, Highgate-road, N.W.
1901		Gardner, Hermann Charles Thomas, Miller Hospital and Royal Kent Dispensary, Greenwich-road, S.E.
1893	Trans.	Gardner, John Addyman, M.A. (Oxon.), F.I.C., Chemical Department, St. George's Hospital, S.W.
1888	Proc.	Gardner, Walter Myers, Prof., M.Sc. (Leeds), Technical College, Bradford; and 3, Fairmount, Manningham, Bradford
1902		Garle, John Longsdon, F.I.C., 136, Holland-road, Kensington, W.
1893	Trans.	Garnett, Henry, 32, Dover-street, Manchester
1889	Trans.	Garrett, Frederic Charles, M.Sc. (Vict.), Armstrong College of Science, Newcastle-on-Tyne
1898		Garside, Arthur Leonard Harry, Gledholt, Lower Broughton-road, Manchester
1906		Garvey, Richard Godfrey Hamilton, c/o Commonwealth Oil Corporation, Ltd., Equitable-buildings, George-street, Sydney, N.S.W.
1884		Gaskell, Joseph, 71, Haworth's-buildings, Cross-street, Manchester
1900		Gasson, William, Dutoitspan-road, Kimberley, S. Africa
1903		Gatehouse, Frank Brooks, 36, Broad-street, Bath
1904	Trans.	Gawler, Robert, M.Sc. (Vict.), A.I.C., 3, South View-terrace, Bennett-road, Headingley, Leeds
1887		Geisler, Joseph Frank, Mercantile Exchange Buildings, Hudson and Harrison-streets, New York City, U.S.A.
1885		Gemmell, George Harrison, F.I.C., 4, Lindsay-place, Edinburgh
1903		Gent, Percy William, Springfield, Misterton, near Gainsboro'
1879		‖Gent, William Thomas, Misterton, Gainsboro'
1896		George, George, F.I.C., Director of Technical Instruction, Auckland, New Zealand

Date of Election.		
1889		‖Gerland, Conrad, M.Sc. (Vict.), Ph.D. (Marburg), Meadow Bank, Accrington
1891		German, George, jun., Mansion House, Ashby-de-la-Zouch
1895		‖Gerrans, Henry Tresawna, M.A. (Oxon.), 20, St. John-street, Oxford
1875		Gerrard, Alfred William, Westward Ho, Wake-green-road, Birmingham
1899		Getman, Frederick Hutton, Dalton Hall, Bryn Mawr College, Bryn Mawr, Penn., U.S.A.
1888		Geyzel, John Lawrence van, Lieut.-Col. I.M.S., M.B. (Aberd.), F.I.C., Medical College, Madras, India
1904		Ghose, Anu, 42, Shambazar-street, Calcutta, India
1890		‖Gibbes, Cuthbert Chapman, M.D. and C.M., (Aberd.), M.R.C.P. (Lond.), D.P.H. (Cantab.), 89, Harley-street, W.
1900		Gibbings, George William, Standard Bank of South Africa, Salisbury, Rhodesia, S. Africa
1897		Gibbons, Joseph Lake, Secondary School, Blyth, Northumberland
1906		Gibbs, Reginald William Malyon, B.A. (Cantab.), B.Sc. (Lond.), Findon Villa, Tennyson-avenue, King's Lynn, Norfolk
1907	Trans.	Gibson, Charles Stanley, B.A. and B.Sc. (Oxon.), M.Sc. (Manc.), Chemical Laboratory, The University, Cambridge
1900		Gibson, John, 15, Tynedale-terrace, Hexham
1892	Trans.	Gibson, John, Prof., Ph.D. (Heidelberg), F.R.S.E., F.I.C., Heriot-Watt College, Edinburgh
1907		Gibson, William Howieson, B.Sc. (Lond.), 23, Wellington-road, Old Charlton, Kent
1888		Gibson, William Humphrey, 122, King's-road, Brighton
1895		Gilbard, John Francis Hutchins, F.I.C., 245, Dalston-lane, Hackney, N.E.
1904		Gilchrist, James Gray, M.A. (Aberd.), B.Sc. (Lond.), Blythswood, Victoria-road, Annan, N.B.
1898		Gilderdale, Frederick, 32, Treherne-road, High West Jesmond, Newcastle-on-Tyne
1883		‖Gill, E. Clarendon, 10, Barrack-road, Christchurch, Hants.
1888		Gill, John, Gwealhellis, Helston, Cornwall
1902		Gill, J. Arthur, Pennsylvania, Lower-green-road, Rusthall, Tunbridge Wells
1898	Proc.	Gilles, William Setten, A.C.G.I., F.I.C., The Cottage, Bocking, Braintree, Essex
1908	Trans.	‖Gilling, Charles, B.Sc. (Lond.), A.I.C., 30, Carnarvon-road, Barnet, Herts.
1901		Gillman, Edward, Government Laboratory, Barbados, West Indies
1885		Girdwood, Gilbert Prout, M.D. and C.M. (McGill), M.R.C.S. (Eng.), F.I.C., 111, University-street, Montreal, Canada

Date of Election.		
1897		Girtin, Thomas, M.A. (Cantab.), c/o H. L. Raphael's Refinery, Thomas-street, Burdett-road, Limehouse, E.
1908	Proc.	Girvan, Arthur Frank, B.Sc. (Lond.), 8, Chatsworth-road, West Norwood, S.E.
1898		Glaister, John, Prof., M.D. (Glas.), M.R.C.S. and L.R.C.P. (Edin.), 18, Woodside-place, Glasgow
1905		Glass, Archibald Melville, B.Sc. (Lond.), 37, Chancery-lane, W.C.
1907		Gledhill, Walter George, M.A. (Cantab.), The School House, Woodbridge
1872		‖Glover, George Thomas, F.I.C., 24, Craven-hill-gardens, Lancaster Gate, W.
1904		Glover, Harry James, Mount Pleasant, Wrattle-road, Westham, near Hastings
1906	Trans.	Glover, Walter Hamis, Ph.D. (Leipzig), 38, Ribblesdale-road, Streatham Park, S.W.
1907	Trans.	Godden, William, B.Sc. (Lond.), A.R.C.S., A.I.C., Station-road-east, Canterbury
1899		Golding, John, F.I.C., Midland Agricultural and Dairy Institute, Kingston, Derby
1878		‖Goldschmidt, S. A., Ph.D., c/o Columbia Chemical Works, 43, Sedgwick-street, Brooklyn, N.Y., U.S.A.
1889		Goldsmith, Byron B., Ph.B. (Columbia), 19, East 74th-street, New York City, U.S.A.
1898		Goldsmith, John Naish, B.Sc. (Vict.), Ph.D. (Heidelberg), 55, Chancery-lane, W.C.
1899		Goltz, Harold Francis Carl, 63, Endymion-road, Brixton Hill, S.W.
1897		Gomess, Alfred Francis Bilderbeck, M.R.C.S. (Eng.), L.R.C.P. (Lond.), 33, Drayton-gardens, South Kensington, S.W.
1904		‖Goodson, John Augustus, F.I.C., Gordon College, Khartoum, Egypt
1890		Goodwin, Thomas Small, Prof., M.B. and C.M. (Glas.), F.R.S.E., Derwent Lodge, London-road, Isleworth, Middlesex
1896	Trans.	Goodwin, William, M.Sc. (Manc.), Ph.D. (Göttingen), South-Eastern Agricultural College, Wye, Kent
1890		Gordon, Colin, Storer's Wharf, Cubitt Town, E.
1875		Gordon, Joseph Gordon, F.I.C., Queen Anne's-mansions, Westminster, S.W.
1905		Gorman, Henry Isaac, 126, Quay, Waterford, Ireland
1909	Trans.	Gortner, Ross Aiken, M.A. (Toronto), B.Sc. (Nebraska), Ph.D. (Columbia), Carnegie Institution, Station for Experimental Evolution, Cold Spring Harbour, Long Island, N.Y., U.S.A.
1890		Gossling, Frank, B.Sc. (Lond.), H.M. Patent Office, Staple Inn W.C.

Date of Election.			
1889	Trans.		||Gott, Benjamin Scaife, M.A. (Cantab.), The Guildhall, Westminster, S.W.
1900			Gough, John Henry, 65, Grange-avenue, Chapeltown-road, Leeds
1897	Trans.		Goulding, Ernest, D.Sc. (Lond.), F.I.C., 88, Sylvan-avenue, Chitts Hill, N.
1887			Gover, Herbert James, 29, Piccadilly, Hanley, Staffs.
1889			Gow, Robert John, Ivy Lea, Hough Green, near Widnes
1893			Gower, Alfred Roland, Ashleigh, Furness-park-road, Barrow
1871	Trans.	C. 1898-01, 1906-7	||Gowland, William, Prof., A.R.S.M., F.R.S., F.I.C., 13, Russell-road, Kensington, W.
1887	Trans.		Goyder, George Arthur, Hawkins-road, Medindie, Adelaide, S. Australia
1862		C. 1880-1	||Graham, Charles, Prof., D.Sc. (Lond.), F.I.C., The Reculvers, Hastings
1880	Trans.		||Graham, Christopher Colborne, F.I.C., Oriel House, Scarborough
1890	Trans.		Grant, James, F.I.C., Oaklands, Gardner-road, Prestwich, near Manchester
1887			Gravill, Edward Day, 42, Walmsley-street, Hull
1882			||Gray, George, Canterbury Agricultural College, Lincoln, New Zealand
1900	Trans.		Gray, Robert Whytlaw, Ph.D. (Bonn), University College, Gower-street, W.C.
1892	Trans.		||Gray, Thomas, Prof., D.Sc. (Glas.), Ph.D. (Jena), The Technical College, Glasgow
1895			Greaves, William Abraham, B.Sc. (Lond.), 23A, Broad-bank, Louth, Lincs.
1885	Trans.	C. 1894-5	||Green, Arthur George, Prof., Hon. M.Sc. (Vict.), F.I.C., The University, Leeds; and 49, Cardigan-road, Headingley, Leeds
1902	Trans.		Green, Clarence James, B.Sc. (Vict.), c/o Messrs. Nicholson and Co., Beaumont Works, St. Albans
1905			Green, Ernest, 113, Hulton-street, Moss Side, Manchester
1908			Green, Henry Hamilton, 36, Princes-square, Regent-park, Glasgow
1878			Green, Herbert, Hayle Mill, Maidstone
1887			Green, John Edward, A.R.S.M., F.I.C., West Clyne, Stretford, Manchester
1909			Green, John Wilberforce, 22, Alwyne-road, Wimbledon, S.W.
1878			Green, Lawrence, Lower Tovil, Maidstone
1908			Green, Leonard Clifford, B.E. (Sydney), Wienholt-street, Torwood, Brisbane, Queensland
1907			Green, William Heber, D.Sc. (Melbourne), The University, Melbourne, Australia
1874	Trans.		||Greenaway, Alfred John, F.I.C., The Orchard, Chertsey, Surrey

Date of Election.			
1907			Greenough, Thomas Rigby, B.A. (Cantab.), A.I.C., Beechwood, Leigh, Lancs.
1885			Greenway, Thomas John, F.I.C., 369, Collins-street, Melbourne, Australia
1894	Proc.		Greeves, Alfred, 25, Balmuir-gardens, Putney, S.W.
1891			Gregory, Alfred John, M.D. and B.S. (Dun. and Cape of Good Hope), M.R.C.S. and D.P.H. (Eng.), B.Sc., Colonial Secretary's Office, Cape Town, S. Africa
1907			Gregory, Joshua Craven, B.Sc. (Lond.), F.I.C., 128, Wellington-street, Glasgow
1906	Trans.		Gregory, Thomas William Diggle, Lynton, Basford-park, Stoke-on-Trent
1896			Grice, Walter Thomas, 9, Dalhousie-square, Calcutta, India
1907			Grieb, Christopher Maurice Walter, B.Sc. (Lond.), A.I.C., c/o Messrs. Lorimer & Co., Ltd., Britannia-row, Islington, N.; and 33, Torrington-park, North Finchley, N.
1908			Griffin, John, B.A. (Cantab.), 7, Carlton-terrace, Batley
1888			‖Griffith, David Agnew, 87, Demesne-street, Seacombe, Birkenhead
1905			Griffiths, John, B.Sc. (Wales), The Grammar School, Larne, Ireland
1902			Griffiths, John Thomas, 9, Greenhill-avenue, Tenby, S. Wales
1879			Griffiths, Thomas, The Cedars, Clapham Common, S.W.
1895			Grime, Herbert, 3, Hill-side, Lancaster
1902			Grimwade, Wilfrid Russell, B.Sc. (Melbourne), 342–346, Little Flinders-street, Melbourne, Australia
1893			Grimwood, Robert George, F.I.C., 43, Leaside-avenue, Muswell Hill, N.
1906			Grindley, Harry Sands, Prof., D.Sc. (Harvard), B.Sc. (Illinois), State University, Urbana, Ill., U.S.A.
1889			Gripper, Harold, Chapel-lane, Wilmslow, Cheshire
1909			Grist, Charles James, Apsley House, Banstead, Epsom
1900			Gritton, Henry Bertie, The Royal Mint, Sydney, N.S.W.
1895			Grossmann, Edward Henry, 12, Alfred-place-west, South Kensington, S.W.
1871	Trans.	C. 1877-8 1909- V.P. 1899-02	‖Groves, Charles Edward, F.R.S., F.I.C., Kennington Green, S.E
1905			Groves, Samuel Ernest, Ingleside, Bridle-road, South Boldon Co. Durham
1901			Groves, William Peer, B.A. (Cantab.), Green Bank, Plumbley Cheshire
1906			Grubb, David Paton, B.Sc. (Edin.), A.R.S.M., 17, Victoria-road Barnsley

Date of Election.			
1897			Grundey, Frederick Roscoe, B.Sc. (Vict.), 33, Woodburn-square, Douglas, Isle of Man
1903			Grundy, Frank Barnes, F.I.C., Red Lodge, King's-road, Richmond, Surrey
1902			Gumersall, Edward, 34, Freegrove-road, N.
1895			Gunn, Alexander, 3, Clitheroe-road, Clapham, S.W.
1902			Gunn, Gilbert, 181, Bury-new-road, Heywood, Lancs.
1906			Gupta, Hem Chandra Dutt, Prof., M.A. (Calcutta), Tej Narayan Jubilee College, Bhagalpur, Bengal, India
1899			Gurney, Elliott Henry, Agricultural College, Gatton, Queensland, Australia
1898			Guthrie, Alexander, B.Sc. (Lond.), Gowanbrae, Dunblane, N.B.
1888	Trans.		Guthrie, Frederick Bickell, F.I.C., Chemical Laboratory, Department of Agriculture, Sydney, N.S.W.
1904	Trans.		Guthrie, John Monteath, 199, Ferry-road, Leith, N.B.
1904	Trans.		Guttmann, Leo Frank, Ph.D. (Heidelberg), A.C.G.I., F.I.C., School of Mining, Queen's University, Kingston, Ontario, Canada, and 18, Aberdare-gardens, N.W.
1897			Guttmann, Oscar, M.Inst.C.E., F.I.C., 60, Mark-lane, E.C.
1909			Gwyer, Alfred George Cooper, B.Sc. (Lond), Ph.D. (Göttingen), Winnington Hall, Northwich
1902	Trans.		Haas, Paul, D.Sc. (Lond.), Ph.D. (Freiburg), 11, Westbourne-park-road, W.
1894			Hadley, Arthur, c/o Messrs. Georges Brewery, Ltd., Bristol.
1898			Hadley, Edwin Bernard, Dalham Villa, Granville-road, Southfields, S.W.
1893			‖Hadley, Henry Edwin, B.Sc. (Lond.), A.R.C.S., School of Science, Kidderminster
1886	Trans.		Haga, Tamemasa, Prof., D.Sc. (Japan), College of Science, University of Tokio, Japan
1881			Hailes, Alfred James de, F.I.C., 15, Red Lion-square, W.C.
1892			Haines, Walter Stanley, Prof., c/o Rush Medical College, Chicago, Ill., U.S.A.
1876	Trans.		Hake, Henry Wilson, Ph.D. (Giessen), F.I.C., Westminster Hospital Medical School, Caxton-street, S.W.
1893			Hale, Henry Ormsby, Oundle School, Oundle
1891	Trans.	C. 1904–7	Hall, Alfred Daniel, M.A. (Oxon.), F.R.S., Lawes Agricultural Trust, Rothamsted Experimental Station, Harpenden, Herts.
1889			Hall, Allan Twistleton, c/o Messrs. Sissons Bros. and Co., Ltd. Hull
1891			Hall, Archibald, F.I.C., 7, Fenchurch-avenue, E.C.

Date of Election.		
1889	Trans.	Hall, John Albert, M.Sc. (Manc.), Victoria Chemical Works, Victoria, British Columbia
1903		Hall, John Thomas, West View, Stanwell, Staines
1907		Hall, Joseph Henry, B.Sc. (Lond.), 84, The Grove, Wandsworth, S.W.
1906		Hall, Octavius, L.R.C.P. and L.R.C.S. (Edin.), L.F.P.S. (Glas.), D.P.H. (R.C.P.S.I.), 6, Devonshire-villas, Plymouth
1906		Hall, Richard John, M.Sc. (Vict.), F.I.C., Sandycroft, Serpentine-road, Egremont, Liverpool
1899		‖Hall, Samuel Godfrey, Hampsterly, Woodside-park, Finchley, N.
1908		Hall, William, B.Sc. (Vict.), Municipal Technical School, The Newarke, Leicester.
1886		Halliburton, William Dobinson, Prof., M.D., B.Sc. and F.R.C.P. (Lond.), M.R.C.S., (Eng.), F.R.S., Church Cottage, 17, Marylebone-road, N.W.
1897		Halliwell, Edward, F.I.C., c/o Ribble Joint Committee, 2, Stanley-place, Preston
1902		Hallowell, Thomas Butterworth, Ladyshawe House, New Mills, West Stockport
1900		Halstead, Reginald Gordon, 12 and 16, Coleman-street, E.C.
1890	Trans.	Hambly, Frederick John, F.I.C., c/o The Electric Reduction Co., Buckingham, Quebec, Canada
1906		Hamer, John, 158, Darwen-road, Bromley Cross, near Bolton, Lancs.
1888	Trans.	Hamilton, James Cullen, Barrows-green, near Kendal, Westmoreland
1898		Hamilton, Oswald, Old Stratford, Stony Stratford, Bucks.
1897		Hamilton, Robert, 3, Westminster-terrace, Ibrox, Glasgow
1875	Trans.	Hamlet, William Mogford, F.I.C., Government Laboratory, Macquarie-street, Sydney, N.S.W.
1904		Hammond, Harold Sankey, Macdonald College, St. Anne de Bellevue, Quebec, Canada
1901		Hammond, Herbert Blackmore, 99, Barton-road, Dover
1857		Hanbury, Cornelius, F.I.C., Plough-court, Lombard-street, E.C.; and Manor House, Little Berkhamsted, Hertford
1900		Handcock, Walter Augustus, F.I.C., Pentlands, 39, The Avenue, Beckenham, Kent
1895	Trans.	Hanes, Edgar Septimus, F.I.C., 34, Sarre-road, West Hampstead, N.W.
1901		Hanley, John, F.I.C., 74, Rowson-street, New Brighton, Cheshire
1902	Trans.	Hann, Archie Cecil Osborn, 54, Wood-vale, Forest Hill, S.E.
1872	Trans.	‖Hannay, James Ballantyne, F.I.C., Cove Castle, Loch Long, N.B.; and The Rectory, Greenford, Southall

Date of Election.			
1889			‖Hanson, Alfred Miall, The Marjorie, Whalley, near Blackburn
1901	Trans.		Hanson, Edward Kenneth, M.A. (Cantab.), F.I.C., Woodthorpe, Royston-park-road, Hatch End, Middlesex
1906			Hanson, Harold Norman, Field Head, Brighouse, Yorks.
1895			Hanson, Weldon, Fairleigh, Clairmont-terrace, Norton, Stockton-on-Tees
1897			Harbord, Frank William, A.R.S.M., F.I.C., Surbiton House, Englefield Green, Surrey
1859	Trans.	S. 1865-7: V. P. 73-6, 80-3, 92-5 P. 1895-7	‖Harcourt, Augustus George Vernon, M.A. (Oxon.), Hon. D.Sc. (Oxon.), Hon. D.C.L. (Dun.), Hon. LL.D. (Montreal), F.R.S., F.I.C., St. Clare, Ryde, Isle of Wight
1887	Trans.	C. 1902–05	‖Harden, Arthur, D.Sc. (Vict.), Ph.D. (Erlangen), F.R.S., F.I.C., 2, Marlborough-road, Richmond, Surrey
1901			Harding, Herbert, B.Sc. (Lond.), 47, Streathbourne-road, Upper Tooting, S.W.
1892			Hardy, James Gordon, c/o The Creston Colorado Mining Co., Torres Sonora, Mexico
1909			Hargreaves, Egerton, M.Sc. (Manc.), Arthog, Garner's-lane, Davenport, Stockport
1876			Hargreaves, James, Peel House-lane, Farnworth, near Widnes, Lancs.
1884			Hargreaves, John, F.I.C., Widnes, Lancs.
1900			Hargreaves, William Arthur, M.A. and B.C.E. (Melbourne), F.I.C., Globe-chambers, Victoria-square-west, Adelaide, S. Australia
1900			Harker, George, D.Sc. (Lond.), 35, Boulevarde, Petersham, Sydney, N.S.W.
1909			Harland, Robert Main, 37, Lombard-street, E.C.
1878			‖Harland, William Dugdale, 48, King-street, Manchester
1897			‖Harley, Vaughan Berkeley, Prof., M.D. (Edin.), M.R C.P. (Lond.), 25, Harley-street, W.
1897			Harman, Harold Wallis, Felday, Links-road, Epsom, Surrey
1903			Harmer, Francis Gerald, Cockburn High School, Leeds
1904			Harold, Frederick Clarkson-, 7, Bolton-road, Port Sunlight, Cheshire
1899			Harper, Henry Winston, M.D. (Virginia), The University of Texas, and 2208, San Antonio-street, Austin, Texas, U.S.A.
1907			Harrington, Arthur George, A.I.C., c/o Dr. Middleton, Municipal Buildings, Singapore, Straits Settlements
1881			Harrington, William Bury, Leeview, Montenotte, Cork
1906			Harris, Frederick James, 1, Alexandra-terrace, Bath-road, Exeter
1896			Harris, Frederick William, F.I.C., 26, John-street, Glasgow
1893			Harris, Harold, The Birmingham Metals and Munitions Co., Ltd., Ammunition Factory, Streetly, nr. Sutton Coldfield, Birmingham

Date of Election.			
1895			Harris, Harry, A.R.S.M., c/o The Tasmanian Smelting Co., Ltd., Zeehan, Tasmania
1894			Harris, Sydney Walters, Devon House, Walter-road, Swansea
1878			‖Harris, Thomas Frederick, B.Sc. (Lond.), Avondale, Thorpe St. Andrew, Norwich.
1888			‖Harrison, Albert, Delamere, Grove-road, South Woodford, Essex
1894	Trans.		Harrison, Edward Frank, B.Sc. (Lond.), F.I.C., 55, Chancery-lane, W.C.; and Langholm, Edgar-road, S. Croydon
1901			Harrison, John Ansted, B.Sc. (Lond.), A.R.C.S., West Villa, Roydon-road, Diss
1888			Harrison, John Burchmore, C.M.G., M.A. (Cantab.), F.I.C., Government Laboratory, Georgetown, Demerara, British Guiana
1902			Harrison, Walter Ernest, 15, Lansdowne-road, Handsworth, Birmingham
1901			Harry, Frederick Thomas, 106, Sandmere-road, Clapham Common, S.W.
1905			Hart, Alfred, M.A. and B.Sc. (Melbourne), Norman-avenue, Hawksburn, Victoria, Australia
1886			Hart, Bertram Harvey, Rosslyn, High-street, Sidcup, S.O., Kent
1900			Hart, Herbert William, 5, Cambridge-road, Ansdell, Lytham, Lancs.
1891			Hart, William Beamont, F.I.C., Laboratory, 8, Exchange-street, Manchester
1882			Hartley, Arthur, The Brewery, Emsworth, Hants.
1897			Hartley, Ernald George Justinian, B.A. (Oxon.), The Bungalow, Foxcombe Hill, near Oxford
1899	Trans.		Hartley, Harold Brewer, M.A. (Oxon.), Balliol College, Oxford
1897			Hartley, Thomas, B.Sc. (Lond.), F.I.C., Swindon and North Wilts. Technical School, Swindon
1866	Trans.	C. 1877-80 V.P. 90-3	†Hartley, Walter Noel, Prof., Hon. D.Sc. (R.U.I.), F.R.S., F.I.C., Royal College of Science, St. Stephen's-green-east, and 10, Elgin-road, Dublin
1890	Trans.		Hartog, Philip Joseph, M.A. (Manc.), B.Sc. (Lond. and Vict.), University of London, South Kensington, S.W.
1900	Trans.		Hart-Smith, James, A.R.C.S., F.I.C., 4, Grafton-mansions, Venn-street, Clapham, S.W.
1900	Trans		Harvey, Alfred William, 13, Pendrell-road, St. Catherine's-park, Hatcham, S.E.
1885			Harvey, Ernest William, A.R.S.M., Stoneleigh, 23, Grove-road, Clapham Park, S.W.
1881			Harvey, Sidney, F.I.C., Watling House, Canterbury

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† Longstaff Medallist, 1906.

Date of Election.			
1907			Harvey, Thomas Featherstone, 69, North-road, West Bridgford, Nottingham
1894			Harvey, William Pellew, 62, London Wall, E.C.
1894			Hatfield, John Adams, F.I.C., c/o Messrs. J. Lysaght, Ltd., Orb Iron Works, Newport, Mon.
1892			Hatton, William Percy, c/o Messrs. W. R. Hatton and Sons, Ltd., Wormwood Scrubs, W.
1880			Hawkes, Alfred Edward, M.D. (Brussels), L.R.C.P. (Edin.), 22, Abercromby-square, Liverpool
1894	Trans.		Haworth, Edward, D.Sc. (Vict.), Sunnyside, Norman-road, Runcorn, Cheshire
1898			Haworth, John, 17, Knaresboro'-road, Millhouses, Sheffield
1909	Trans.		Haworth, Walter Norman, M.Sc. (Manc.), Dacca House, Chorley
1909			Haws, John Frederick, 34, Rock-lane-east, Rock Ferry, Birkenhead
1905	Trans.		Hawthorne, John, Municipal Technical Institute, Belfast
1907			Hay, William, Holton House, Beverley-road, Hull
1905			Hayman, Jack Vernon Johnson, A.C.G.I., A.I.C., c/o Société Anonymé des Ciments, Massarah, Ligne de Helouan, Cairo, Egypt
1900			Haynes, James Herbert, B.Sc. (Vict.), Sennen, 65, Kennington-avenue, Ashley Down, Bristol
1909			Hayward, Eric, A.I.C., c/o W. R. Criper, Esq., Konnagar House, Konnagar, near Calcutta
1906			Hayworth, William Prince, A.I.C., 47, Highfield-road, Dartford,
1903			Heasman, Harold Montague, 2, Broadway, Westminster, S.W.
1891			Heath, John William, 1, Carlyle-square, Chelsea, S.W.
1898			Heaton, John, Southcliffe, Roker, Sunderland
1902			Heaton, Noël, B.Sc. (Lond.), Denmark House, Stonebridge Park, N.W.
1908			Hebron, John Henry Albert, B.Sc. (Lond.), Beechwalk, Littleover, Derby
1906	Trans		Hedley, Edgar Percy, Ph.D. (Leipzig), A.R.C.S.I., Pension Hella, Bolleystrasse 38, Zürich V., Switzerland
1899			Hedley, George Ward, M.A. (Oxon.), The College, Cheltenham
1905			Heely, Frederick William, 10, Yarborough-street, Grimsby
1876		C. 1895-9	Hehner, Otto, F.I.C., 11, Billiter-square, E.C.
1889			Helbing, H. B., 63, Queen Victoria-street, E.C.
1875			‖Hellon, Robert, Ph.D. (Heidelberg), A.R.S.M., F.I.C., Whinthwaite, Seascale, viâ Carnforth
1872			‖Helm, Henry James, I.S.O., F.I.C., Simonstone, 27, Hammelton-road, Bromley, Kent
1899			Hembrough, James, A.R.C.S., A.I.C., Science, Art and Technical School, Market-street, Newton Abbott

Date of Election.			
1900			Hemingway, Frank Christian Richard, 133, Front-street, New York City, U.S.A.
1898	Trans.		Hemmy, Arthur Stanley, Prof., B.A. (Cantab.), M.Sc. (Melbourne), Government College, Lahore, India
1885	Trans.		‖Henderson, George Gerald, Prof., M.A., D.Sc. (Glas.), F.I.C., The Technical College, 204, George-street, Glasgow
1895	Trans.		Henderson, James, Ph.D. (Münich), B.Sc. (St. Andrews), c/o Horlick's Malted Milk Co., Racine, Wisconsin, U.S.A.
1905			Henderson, James Alexander Russell, Prof., B.Sc. (Glas.), Chihli Provincial College, Paotingfu, North China
1900	Trans.		Henderson, John Brownlie, F.I.C., Government Analyst, Brisbane, Queensland
1892			Hendrick, James, B.Sc. (Lond.), F.I.C., Marischal College, Aberdeen
1903			Hendrickson, Arthur V., The Gas Works, Lower Sydenham, S.E.
1901			‖Henley, The Hon. Francis Robert, M.A. (Oxon.), F.I.C., 9, Beaufort-gardens, S.W.
1905			Hennings, Carl Richard, Ph.D. (Freiburg), 19, St. Dunstan's-hill, E.C.
1899	Trans.		‖Henry, Thomas Anderson, D.Sc. (Lond.), 70, Doneraile-street, Fulham, S.W.
1905	Trans.		Henstock, Herbert, M.Sc. (Vict.), Ph.D. (Zürich), Huxley, near Chester
1904			Henzell, Archie Willoughby, Thomas Hanbury School, Shanghai, China
1895			Heriot, Thomas Hawkins Percy, 37, Church-crescent, Muswell Hill, N.
1871			Herman, Douglas, F.I.C., Rainhill, Lancs.
1876	Trans.	C. 1892-3	Heron, John, B.E. (R.U.I.), F.I.C., 110, Fenchurch-street, E.C.
1908			Heron, John Maxwell, North House, Mistley, Essex
1906			Herty, Charles Holmes, Prof., Ph.D. (Johns Hopkins), Ph.B. (Georgia), University of North Carolina, Chapel Hill, N.C., U.S.A.
1905			Hetherington, Arthur Lonsdale, B.A. (Cantab.), Aingalay, Stormont-road, Highgate, N.
1892	Trans.	C. 1903-05, 1908-	Hewitt, John Theodore, M.A. (Cantab.), D.Sc. (Lond.), Ph.D. (Heidelberg), 7, The Avenue, Surbiton, B.O., Surrey
1900			Hewitt, Samuel, 58, Dover-street, Unthank-road, Norwich
1892			Hewlett, John Cooke, 35–42, Charlotte-street, Great Eastern-street, E.C.
1883	Trans.	{C. 1897-1901}	‖Heycock, Charles Thomas, M.A. (Cantab.), F.R.S., 3, St. Peter's-terrace, Cambridge
1909	Trans.		Hibbert, Harold, M.Sc. (Vict.), Ph.D. (Leipzig), F.I.C., Creston, Marple Bridge, Stockport

Date of Election.		
1876	Trans.	Hibbert, Walter, F.I.C., 144, Walm-lane, Willesden Green, N.W.
1909		Hickinbotham, Reginald Vernon, 144, West-street, Maritzbnrg, Natal, S. Africa
1881		‖Hiddingh, Michael, Newlands, near Capetown, S. Africa
1905		Higgins, John Michael, 39, Queen-street, Melbourne, Australia
1907		Higham, Richard, 133, Mauldeth-road, Withington, Manchester
1909		Higson, Frank, Ivybank, Castle-street, Haulgh, Bolton
1908	Trans.	Hilditch, Thomas Percy, B.Sc. (Lond.), A.I.C., 3, Lynton-villas, Sydenham-park-road, Sydenham, S.E.
1882		‖Hill, Alexander, 4, Broad-street-place, E.C.
1896	Trans.	Hill, Arthur Croft, M.A., M.D. and B.S. (Cantab.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), 169, Cromwell-road, S.W.
1906	Trans.	Hill, Arthur Edwin, c/o A. A. Hill, Esq., Constantinople
1896		‖Hill, Charles Alexander, B.Sc. (Lond.), F.I.C., 26, Courtfield-gardens, S.W.
1896	Trans.	Hill, Ernest George, Prof., Sc.D. (Dub.), B.A. and B.Sc. (Oxon.), Muir College, Allahabad, India
1905		Hill, William Basil, Eastfield, Stockton-lane, York
1894		‖Hills, Edmond Herbert, Capt. R.E., 32, Prince's-gardens, S.W.
1892		‖Hills, Harold Fletcher, Commercial Gas Works, Stepney, E.
1906		Hills, James Stuart, F.I.C., Oxford Works, Tower Bridge-road, S.E.
1898		Hills, Thomas Herbert, c/o The Almo Food Co., Ltd., Tile Kiln-lane, Upper Edmonton, N.
1873		‖Hills, Walter, 50, Wigmore-street, W.
1896		Hinchley, John William, A.R.S.M., 55, Redcliffe-road, S.W.
1906		Hines, Charles Percy, B.Sc. (Lond.), The Grammar School, Dartford, Kent
1908		Hinks, Edward, B.Sc. (Lond.), F.I.C., 16, Southwark-street, S.E.
1900		Hinks, Percy John, A.R.C.S., F.I.C., Woodstock, Beaconsfield-road, Blackheath, S.E.
1894		Hirsch, Charles Theodore William, M.R.C.S. (Eng.), L.R.C.P. (Lond.), Charlinch, Rectory-road, Woolwich, S.E.
1870		Hislop, George Robertson, Gasworks, Blackstoun-road, Paisley
1898		‖Hislop, Lawrence, Gasworks, Uddingston, Glasgow
1898		Hislop, Robert Findlay, Greenhill House, Paisley
1883		‖Hobbs, Bedo, Lamb Brewery, Chiswick, W.
1905		Hobsbaum, Isaac Berkwood, c/o Messrs. Lockett, Bros. & Co., Iquique, Chili, S. America
1901		Hobson, Edwin, Howdendyke, Howden, Yorks.
1884		Hodges, Herbert John, Brewery House, York-buildings, Southampton

Date of Election.			
1882	Trans.		‖Hodgkin, John, F.I.C., 97, Hamlet-gardens-mansions, Ravenscourt Park, W.
1879	Trans.	C. 1883-5, 1907-	Hodgkinson, William Richard Eaton, Prof., Ph.D. (Würzburg), F.I.C., 89, Shooter's Hill-road, Blackheath, S.E.
1886			‖Hodgson, Christopher, 33, Oakdale-road, Netheredge, Sheffield
1873			‖Hodgson, Henry Tylston, M.A. (Cantab.), Harpenden, Herts.
1904			Hodgson, Thomas Reginald, B.A. (Cantab.), A.I.C., City Laboratory, 18, Prince-street, Bristol
1885			Hogg, Edward Grindle, 1, Southwick-street, Hyde Park-square, W.
1883			Hogg, W. Douglas, M.D. (Paris), 62, Champs Elysées, Paris
1904			Hoit, Alfred Henry, 4, Montgomerie-road, Southsea
1876			Holcroft, Harold, M.A. (Cantab.), Parkdale, Wolverhampton
1902			Holdcroft, George Frederick, c/o The Hull Oil Manufacturing Co., Ltd., Stoneferry, Hull
1908			Holden, George Edward, 23, Durnford-street, Middleton, Manchester
1885			Holgate, Thomas, 5, Victoria-street, Westminster, S.W.
1908			Holland, Frank William Crossley-, Connaught Club, Connaught House, Marble Arch, W.
1908			Holland, Norman, 4907, Sherbrooke-street-west, Montreal, Canada
1876			Holland, Philip, F.I.C., 22, Taviton-street, Gordon-square, W.C.
1902			Hollingworth, David Vincent, Gas Offices, Bloom-street, Salford
1905			Hollins, Cecil, 13, Clifton-road, Brockley, S.E.
1891			Holloman, Frederick Richard, Liston-street, Plaistow, E.
1886			Holloway, George Thomas, A.R.C.S., F.I.C., 57 and 58, Chancery-lane, W.C.
1895			Holme, Arthur Edward, M.A. (Oxon.), The Wheelwright Grammar School, Dewsbury
1897	Trans.		Holmes, John, Government Laboratory, Clement's Inn Passage, W.C.
1898	Trans.		Holroyd, George William Fraser, B.A. (Oxon.), The Chemical Works, Shoreham, Sussex
1902	Trans.		‖Holt, Alfred, jun., B.A. (Cantab.), Crofton, Aigburth, Liverpool
1893			Holthouse, Harold Bertram, 12, Melton-grove, West Bridgford, Nottingham
1898			Homfray, David, B.Sc. (Lond.), F.I.C., The Ings, Misterton, near Gainsborough
1878			Hooker, Ayerst Henham, F.I.C., Board of Health, Cairo, Egypt
1892	Trans.		Hooker, Samuel Cox, Ph.D., 4422, Chestnut-street, Philadelphia, U.S.A.
1883			‖Hooper, David, F.I.C., Economic and Art Section, Indian Museum, 1, Sudder-street, Calcutta, India

Date of Election.			
1888		C. 1907-08	‖Hooper, Egbert Grant, F.I.C., 16, Royal-avenue, Sloane-square, S.W.
1891			‖Hooper, Ernest Frederick, c/o Messrs. Brotherton & Co., Ltd., Wear Tar Works, South Dock, Sunderland
1907	Proc.		Hooton, William Marrs, M.A. (Oxon.) M.Sc. (L'pool), F.I.C., Repton School, Repton, Burton-on-Trent
1907			Hope, Geoffrey Dodleston, B.Sc. (Vict. and L'pool), Ph.D. (Halle), c/o Indian Tea Association, Calcutta, India
1906			Hopkins, Frederick Gowland, M.A. (Cantab.), M.B., D.Sc., and L.R.C.P. (Lond.), M.R.C.S. (Eng.), F.R.S., F.I.C., 55, St. Andrew's-street, Cambridge
1909			Hopkinson, Reginald, B.Sc. (Lond.), Cromwell Lodge, Huntingdon
1904			Horn, George Mathieson, Capt., Ivylands, Epping, Essex
1908			Hornby, Percy Hulme, 111, Nine Elms-lane, S.W.
1894			‖Hornby, Richard, M.A. (Oxon.), Haileybury College, Hertford
1908			Horrobin, Arthur, c/o Bombay, Baroda and Central India Railway Co., Ajmer, Rajputana, India
1904			Horrod, George William Thomas, 7A, Lyric-road, Barnes, S.W.
1897			Horseman, James Walter, Elstow School, Bedford
1892			Horsfall, John, 4, Grange-avenue, Rawtenstall, Manchester
1901	Proc.		Horton, Edward, B.Sc. (Lond.), 10, Smith-street, Chelsea, S.W.
1909			Hoseason, James Henry, Alderside, Timperley, Altrincham
1902			Hosking, Arthur Francis, c/o The Tasmania Gold Mining Co., Ltd., Beaconsfield, Tasmania
1886			‖Hoskins, Arthur Percy, F.I.C., Clonlee, Rosetta-park, Belfast
1909			Hough, Ralph, 14, Longford-place, Victoria-park, Manchester
1907			Houghton, Edward, Dudley House, Avondale-road, Chesterfield
1871			Houlder, William Washington, North Hyde House, Southall
1887	Proc.		Houlding, William, B.Sc. (Edin.), 34, Tynemouth-street, Liverpool
1882			‖Howard, Alfred Gravely, Burnt House, Chigwell, Essex
1901			Howard, Bernard Farmborough, F.I.C., Quantocks, Woodford Green, Essex
1870		C. 1875-9, 83-5, 98-1902. V.P. 1886-9, 1903-06	‖Howard, David, J.P., F.I.C., Devon House, Buckhurst Hill, Essex
1887	Trans.		‖Howard, David Lloyd, Little Friday Hill, Chingford, Essex
1889			Howard, George William, Calverley, Tunbridge Wells
1875			Howard, Thomas, F.I.C., 50, Ellington-street, Liverpool-road, N.
1903			Howarth, John George, Danes Dyke, Chart-road, Reigate, Surrey
1882			Howe, James Lewis, Prof., M.D. (Louisville), Ph.D. (Göttingen), B.A. (Amherst), Washington and Lee University, Lexington, Va., U.S.A.

Date of Election.		
1880		Howell, Reginald, 95A, Southwark-street, S.E.
1905		Howgate, James Henry, B.A. (Lond.), The Grammar School, Huntingdon
1876		Howie, William Lamond, 26, Neville-court, Abbey-road, N.W.
1903		Howorth, Franklin Wise, 46, Lincoln's Inn-fields, W.C.
1889		‖Hoyle, Richard Ashworth, Elm-grove, Fairlawn-road, Lytham, Lancs.
1889		Hoyles, Henry Richardson, 10, Fore-street, Wellington, Somerset
1907		Hoyten, William James, M.A., M.R.C.S. (Eng.), F.R.C.P. (Lond.), 37, Revelstoke-road, Wimbledon Park, S.W.
1907		‖Hubbard, The Hon. Raymond Egerton, B.A. (Oxon.), c/o Messrs. Egerton, Hubbard & Co., St. Petersburg, Russia; and Addington Manor, Winslow, Bucks.
1900		Hudson, Edmund Foster, M.A. (Cantab.), Churcher's College, Petersfield, Hants.
1878		Hudson, William, B.Sc. (Lond.), The Lilies, Twickenham
1899	Trans.	Hübner, Julius, M.Sc. (Manc.), F.I.C., Ash-villa, Cheadle Hulme, Cheshire
1903		Hughes, Edwin Reginald, 106, Queen Victoria-street, E.C.
1907		Hughes, Francis Townshend Cunynghame, Major, H.M.'s Assay Office, 47/1, Strand-road, Calcutta, India
1894	Trans.	Hughes, Frank, c/o Khedivial Agricultural Society, P.O. Box 63, Cairo, Egypt
1880	Trans.	Hughes, George Henry, 155, Fenchurch-street, E.C.
1868		Hughes, John, F.I.C., Analytical Laboratory, 79, Mark-lane, E.C.
1906		Hughes, John Gerard, 2, Canute-road, Southampton
1908		Hughes, Joseph Albert, School of Mines, Charters Towers, Queensland, Australia
1896		Hughes, Joshua Arthur, The Square, Abercarn, Mon.
1885		Hughes, Theophilus Vaughan, A.R.S.M., F.I.C., 4, George-road, Edgbaston, Birmingham
1882		Hughes, Thomas, F.I.C., Borough Analyst's Office, 31, Loudoun-square, Cardiff
1908		Hull, Thomas Ernest, 6, Selborne-terrace, Greenbank, Darlington
1904		Hulme, John, Ph.D. (Halle), 5, Duke-street, Macclesfield
1907	Trans.	Humphries, Herbert Brooke Perren, B.Sc. (Lond.), A.R.C.S., 117, Avenell-road, Highbury, N.
1883		Humphrys, Norton Henry, Gas Engineer, Salisbury
1899		Hunter, Archibald Glen Kidston-, c/o The Freemantle Wool Scouring Co., 13, Weld-chambers, Perth, W. Australia
1883		Hunter, John, F.I.C., 37, Chambers-street, Edinburgh
1885		Hunter, Matthew, M.A. (Oxon.), Rangoon College, Rangoon, Burma

Date of Election.		
1878		Huntington, Alfred Kirby, Prof., A.R.S.M., F.I.C., Metallurgical Laboratory, King's College, Strand, W.C.
1893	Trans.	Huntly, George Nevill, B.Sc. (Lond.), A.R.C.S., F.I.C., 96, Gower-street, W.C.
1902	Trans.	Hurtley, William Holdsworth, D.Sc. (Lond.), St. Bartholomew's Hospital, E.C.
1861		Huskisson, Henry Owen, F.I.C., 74, Swinton-street, Grays Inn-road, W.C.
1907		Hussey, Arthur Vivian, A.C.G.I., c/o British Aluminium Co., Ltd., Foyers, N.B.
1900		Hutchin, Henry William, Basset-road, Camborne, Cornwall
1894		Hutchinson, Alfred, M.A. (Cantab.), B.Sc. (Lond.), 3, Windsor-road, Saltburn-by-the-Sea
1890	Trans.	||Hutchinson, Arthur, M.A. (Cantab.), Ph.D. (Würzburg), Pembroke College, Cambridge
1884		||Hutchinson, Christopher Clarke, F.I.C., 13, The Boltons, South Kensington, S.W.
1908		Hutchinson, Henry Brougham, Ph.D. (Göttingen), Ashby Villa, Devonshire-road, Harpenden, Herts.
1907		||Hutchinson, William Doge, B.A. (Oxon.), Knighton Hayes, Leicester
1901	Trans.	Hutton, Robert Salmon, D.Sc. (Vict.), West-street, Sheffield
1901		Hyder, Alfred James, B.Sc. (Lond.), Dinwoodie, Connaught-avenue, Chingford, Essex
1900		||Ichioka, Tajiro, Prof., Minamihara, Hiratsuka, Japan
1888		Idris, Thomas Howell Williams, M.P., 110, Pratt-street, Camden Town, N.W.
1907	Trans.	Ingham, Harry, M.Sc. (Vict.), 26, Hamilton-street, Bury, Lancs.
1889	Trans.	||Ingle, Herbert, B.Sc. (Leeds), F.I.C., Grove House, Elm-grove-road, Gorleston, Great Yarmouth
1904	Trans.	Inglis, John Kenneth Harold, Prof., D.Sc. (Edin.), M.A., and B.Sc. (N.Z.), University College, Reading
1901		Ingram, Beresford, Department of Agriculture and Technical Instruction, 17, Ely-place, Dublin
1897	Trans.	Innes, William Ross, D.Sc. (Vict.), Ph.D. (Heidelberg), F.I.C., 6, Griffiths-road, Wimbledon, S.W.
1901		||Ionides, Stephen Archigenes, 163, N. 64th-avenue, Oak Park, Ill., U.S.A.
1908	Trans.	Irvine, James Colquhoun, Prof. D.Sc. (St. Andrews), Ph.D. (Leipzig), Dunmurry, Rathelpie, St. Andrews
1906		||Irving, Henry Carlyle, B.A. (Oxon.), 14, Heath Hurst-road, Hampstead, N.W.

Date of Election.			
1883			‖Irwin, Wilfred, Inglehurst, Higher-lane, Stand, Manchester
1892			‖Isaac, John F. V., M.A. (Oxon.), 38, Silver-crescent, Gunnersbury, N.
1885			Ivatt, Albert, M.A. (Cantab.), The Engadine, Histon, Cambridge
1905			Jack, Maurice Brooks, Bedford Villa, 74, Park-avenue-south, Crouch End, N.
1894			Jackman, Edwin James, 60, Belgrave-road, Ilford, Essex
1883			‖Jackson, Alfred Henrick, Prof., B.Sc. (Vict.), M.Inst.E.E., The Electrical Engineering School, 349, Collins-street, Melbourne, Australia
1894	Trans.		Jackson, David Hamilton, M.A. and B.Sc. (N.Z.), Ph.D. (Heidelberg), 95, Abbey-road, N.W.
1882			Jackson, Edward, F.I.C., Raven's Clift, Oxford-road, Moseley, Birmingham
1907			Jackson, Ernest Wilfrid, 3, Leven-street, Saltburn-by-the-Sea, Yorks.
1900	Trans.		Jackson, Henry, M.A. (Cantab.), Downing College, Cambridge
1884	Trans.		Jackson, Herbert, Prof., F.I.C., Chemical Laboratory, King's College, Strand, W.C.
1909			Jackson, Robert Ernest, York-villa, Shepherd's-lane, Dartford
1892			‖Jackson, Samuel, A.R.C.S., F.I.C., c/o Messrs. Binny & Co., Ltd., Madras, India
1907			Jackson, Victor George, 21, Frankfurt-road, Herne Hill, S.E.
1902			Jackson, William Brannan, Kingston, Airdrie, N.B.
1903			Jackson, William Henry, 73, Church-street, West Hartlepool
1887			‖Jadhava, Khasberao B., M.R.A.C., Nawasari, Bombay Presidency, India
1900			Jaffé, Adolf, 8, Leyburn-grove, Shipley, Yorks.
1878	Trans.		Jago, William, Barrister-at-Law, F.I.C., 3, Crown Office-row, Temple, E.C.; and 17, Wilbury-avenue, Hove, Sussex
1895			James, Alfred, 2, Broad-street-place, E.C.
1904	Trans.		James, Thomas Campbell, M.A. (Cantab.), B.Sc. (Wales), Edward Davies' Chemical Laboratories, University College of Wales, Aberystwyth
1904			James, Walter Richmond, 20, Parkdale, Wolverhampton
1878			Jamieson, Alexander, 238, Castellain-mansions, Maida Vale, W.
1901	Proc.		Jamieson, James Sprunt, F.I.C., Government Laboratory, Durban, Natal, S. Africa
1879	Trans.	C.1882-5 F.S. 85-91 V.P.95-9	†‖Japp, Francis Robert, Prof., M.A. and Hon. LL.D. (St. Andrews), F.R.S., F.I.C., The University, Aberdeen

† Longstaff Medallist, 1891.

Date of Election.		
1902		Jardin, David Smith, A.R.C.S.I., F.I.C., Rathgar House, Rathgar, Co. Dublin
1902		Jardine, Douglas Kennedy, B.Sc. (Vict.), c/o Daily Chronicle Office, Georgetown, Demerara, British Guiana
1882		Jarmay, Gustav, F.I.C., Hartford Lodge, Hartford, Cheshire
1905		Jarrard, William John, B.Sc. (Lond.), A.R.C.S., The University, Sheffield
1898		Jee, Edwin Charles, D.Sc. (Lond.), F.I.C., 39, Pepys-road, New Cross, S.E.
1896	Proc.	Jeffers, Ernest Haynes, 87, Kyrle-road, West-side, Clapham Common, S.W.
1909		Jeffery, John Hugh, 10 Daysbrook-road, Streatham Hill, S.W.
1901	Proc.	Jemmett, William Henry Coutts, M.A. (Cantab), Dagnall, Bakewell, Derbyshire
1891	Trans.	Jenkins, Henry Charles, A.R.S.M., Assoc. M.Inst.C.E., Balmoral, Green-lane, Redruth, Cornwall
1904		Jenkins, Herbert, 125, Hampton-road, Redland, Bristol
1892		‖Jenkins, John H. B., Chemical Laboratory, Great Eastern Railway Works, Stratford, E.
1906	Trans.	Jenkinson, Ernest Arthur, 16, Granville-street, Skipton
1894		Jenks, Robert Leonard, A.C.G.I., F.I.C., Central Excise Laboratory, Kasauli, Punjaub, India
1907		Jennings, John Atkinson, 34, Streatham-place, Brixton Hill, S.W.
1907		Jennings, Sidney James, B.Sc. (Lond.), 367, Queen's-road, New Cross, S.E.
1894		Jennison, Francis Herbert, F.I.C., The Limes, Bitton, Bristol
1907		Jensen, Charles William Lamb, Lauriston, Grand-avenue, Southbourne, Bournemouth
1897	Trans.	‖Jerdan, David Smiles, M.A. (Glas.), D.Sc. (Vict.), Ph.D. (Heidelberg), Temora, Colinton, Midlothian
1898		Jessop, Samuel Morton, 19, Burton-street, Wakefield
1879		Jewson, Francis Albert Bowen, F.I.C., 24, York-road, Hove, Sussex
1901		Johnson, Charles Harold, M.D., C.M., F.R.C.S. and M.R.C.P. (Edin.), Beaumont, Northcote, Melbourne, Australia
1908		Johnson, Grove, c/o J. St. A. Johnson, Esq., Horley
1897	Trans.	Johnson, Harold, D.Sc. (Brussels), 5 and 6, Fawkes-buildings, Great Tower-street, E.C.
1883		Johnson, James Edward, F.I.C., 40, Idmiston-road, Stratford, E.
1904		Johnson, John Richard, 10, Copley-park, Streatham Common, S.W.
1897		Johnson, Otis C., Prof., 730, Thayer-street, Ann Arbor, Mich., U.S.A.

Date of Election.		
1906		Johnston, Archibald McArthur, Box 108, Germiston, Transvaal, S. Africa
1904		Johnston, John Haslam, M.Sc. (Vict.), F.I.C., Public Offices, Hampton, Middlesex
1896		Johnstone, James, F.I.C., Braehead, Parkhill, Rutherglen
1901	Trans.	Jollyman, Walter Henry, F.I.C., c/o F. W. Jollyman, Esq., Charlton-road, Keynsham, Bristol
1903		Jones, Alfred Owen, c/o Messrs. H. J. Packer & Co., Ltd., Greenbank, Bristol
1907		Jones, Benjamin Owen, Boksburg, Transvaal, S. Africa
1905	Trans.	Jones, Bernard Mouat, B.A. (Oxon.), Prof., Government College, Lahore, India.
1898		Jones, Edward, B.Sc. (Lond.), F.I.C., 15, Macaulay-road, Clapham, S.W.
1906		Jones, Edward Rees, Llangedwyn Vicarage, Oswestry
1905		Jones, Edward Towyn, B.Sc., (Wales), A.I.C., 29, Somerset-road, Newport, Mon.
1871	Trans.	Jones, Edward William Taylor, F.I.C., The Oaklands, and 10, Victoria-street, Wolverhampton
1873	Trans.	Jones, Francis, M.Sc. (Manc.), F.R.S.E., Beaufort House, Alexandra-park, Manchester
1894		‖Jones, George Cecil, A.C.G.I., F.I.C., 43, Great Tower-street, E.C.
1893		Jones, Hedley Gordon, F.I.C., 32, Beechhill-road, Eltham, S.E.
1876	Trans.	‖Jones, Henry Chapman, F.I.C., Royal College of Science, South Kensington, S.W.
1909		Jones, Henry Humphrys, 18, Colquitt-street, Liverpool
1878		Jones, Henry Williams, Earlsdon-lane and Styvechale-avenue, Coventry
1900	Trans.	Jones, Humphrey Owen, M.A. (Cantab.), D.Sc. (Lond. and Wales), Clare College, Cambridge
1904		Jones, Horace Francis, Rose Bank, Cambridge-road, Uxbridge
1890		Jones, John Archyll, B.Sc. (Lond.), Reethville, Park-road, West Hartlepool
1901		Jones, John Lloyd Thomas, Lieut.-Col., I.M.S., M.B. (Dun.), M.R.C.S. (Eng.), D.P.H. (Cantab.), His Majesty's Assay Office, Calcutta, India
1892	Trans.	Jones, Lionel Manfred, B.Sc. (Lond.), Municipal Technical School, Suffolk-street, Birmingham
1899		Jones, Lauder William, A.B. (Williams Coll.), Ph.D. (Chicago), University of Chicago, Chicago, Ill., U.S.A.
1906		Jones, Llewelyn Thomas, B.Sc. (Wales), 22, Ashfield-terrace, Bingley, Yorks.
1891		Jones, Moses William, The Cottage, Brislington, Bristol

Date of Election.			
1905			Jones, Percy Walter, A.I.C., Technical College, Rockhampton Queensland
1901			Jones, Robert Henry, M.Sc. (Vict.), The Harris Institute, Presto
1898			Jones, Thomas Hill-, Invicta Mills, Bow-common-lane, E.
1904			Jones, William App., A.M. (North Carolina), Ph.D. (Baltimore) c/o The Boston Artificial Leather Co., Metropolitan Building New York City, U.S.A.
1904	Trans.		Joseph, Alfred Francis, Prof., B.Sc. (Lond.), A.R.C.S., Ceylo Technical College, Colombo, Ceylon
1893	Trans.	C. 1906-09	Jowett, Hooper Albert Dickinson, D.Sc. (Lond.), 5, Miskin-road Dartford, Kent
1900			Joyce, Thomas Goode, B.Sc. (Lond.), F.I.C., Lyttleton Preserv and Drysaltery Works, Bromford-lane, West Bromwich
1893			Káká, Sorabji Manekji, Devon Villa, Karachi, Sind, India
1886	Trans.		Kawakita, Michitada, Engineering College, Tokio, Japan
1905	Trans.		Kay, Sydney Alexander, D.Sc. (St. Andrews), United College St. Andrews, N.B.
1881	Trans.		Kay, William Edward, The Thorns, Prestwich-park, Manchester
1889			Kaye, James Robert, M.B. and C.M. (Glas.), D.P.H. (Cantab.) Medical Officer of Health, West Riding of Yorkshire, Wakefiel
1907	Trans.		Kaye, John, M.A. and B.Sc. (Glas.), North Britain Glass Works Perth, N.B.
1886	Trans.	C. 1903-5	‖Keane, Charles Alexander, D.Sc. (Vict.), Ph.D. (Erlangen) F.I.C., The Sir John Cass Technical Institute, Jewry-street, Aldgate, E.C.
1909			Keeble, Horace, Wereham Hall, Stoke Ferry, Norfolk
1882			‖Keen, Austin, Hon. M.A. (Cantab.), Cefn Llys, Bentley-road Cambridge
1908			Keiller, Patrick Anderson, B.Sc. (St. Andrews), c/o Colomb Commercial Co., Ltd., Colombo, Ceylon
1894			‖Kellas, Alexander Mitchell, B.Sc. (Lond.), 2, St. Mark's-square Regent's Park, N.W.; and Chemical Dept., Middlesex Hospita Medical School, W.C.
1874			Kellner, William, Ph.D. (Göttingen), F.I.C., 135, Victoria-road, Old Charlton, S.O., Kent
1867			‖Kemp, David Skinner, 52, Coverdale-road, Shepherd's Bush, W.
1882			‖Kemp, William Joel, F.I.C., Caerthillian, Sidcup, S.O., Kent
1903			Kemp-Welch, Maurice, B.A. (Cantab.), Parkstone, Weybridge, Surrey
1884			Kendall, George Frederic, B.A. (Cantab.), The Hollies, Stratford-on-Avon

Date of Election.			
1874			Kendall, James Alfred, F.I.C., Lonesome Chemical Works, Streatham Common, S.W.
1896			‖Kennicott, Cass Langdon, Chicago Heights, Illinois, U.S.A.
1903			Kent, Thomas Oliver, 42, Loughboro'-park, Brixton, S.W.
1889			Kenwood, Henry Richard, M.B. and C.M. (Edin.), L.R.C.P. (Lond.), Wadhurst, 150, Bethune-road, Stamford Hill, N.
1908	Trans.		Kenyon, Joseph, B.Sc. (Lond), A.I.C., 6, Cheltenham-street, Blackburn
1895			Kenyon, Richard Ernest, M.Sc. (Vict.), Fleetwood, Newland, Banbury
1903			Kerr, James Stewart, A.R.C.S., F.I.C., Methodist College, Belfast
1883			Kerry, William Hugh Rubens, The Sycamores, Windermere
1900			Kershaw, James Henry, Corporation Sewage Works, Dalton, Rotherham, Yorks.
1901			Kettle, James David, B.Sc. (Lond.), A.I.C., 1, Vardens-road, St. John's-hill, Battersea, S.W.
1902			Kewley, James, M.A. (Cantab.), c/o De Bataafsche Petroleum Maatschappij, Balik Papan, Dutch Borneo
1905			Killby, Leonard Gibbes, B.A. and B.Sc. (Oxon.), 20, Portland-court, Great Portland-street, W.
1900			Kilner, George Washington, M.A. (Lond.), Ormefield, Long-lane, Church-end, Finchley, N.
1884			Kilpatrick, William Stirling, Hawklin, Stuart-drive, Colston, near Bishopbriggs
1903			Kin, Thein, B.A. (Calcutta), Chemical Examiner's Office, Rangoon, Lower Burma, India
1872	Trans.	C. 1887-92	‖Kinch, Edward, Prof., F.I.C., Royal Agricultural College, Cirencester
1907			King, Albert Theodore, B.Sc. (Lond.), A.I.C., Chemical Department, The University, Leeds; and Church-hill, Horsell, Woking, Surrey
1881	Trans.		King, Alfred John, Rock Bank, Bollington, near Macclesfield
1902			‖King, Frank Eustace, B.Sc. (Lond.), F.I.C., 75, Gracechurch-street, E.C.
1903			King, Frank William George, 15, Almond-road, Tottenham, N.
1897			King, Herbert, M.Sc. (Vict.), F.I.C., 8, Avenue-road, Scarborough
1908			King, James Kirkman, B.A. (Cantab.), Downside College, Stratton-on-the-Fosse, Bath
1876			King, John Falconer, F.I.C., 30, Chambers-street, Edinburgh
1902			King, Sidney Isaac, Hazeldene, Avenue-road, Bexley Heath, Kent

Date of Election.			
1895			Kingdon, George Holman, M.A. (Oxon.), c/o Messrs. Crosfield Limited, Warrington ; and Ivy Lodge, Froghall, Warrington
1872	Trans.		‖Kingzett, Charles Thomas, F.I.C., Newlands, St. George's-avenue, Weybridge, Surrey
1895			‖Kinnicutt, Leonard Parker, Prof., Sc.D. (Harvard), Worcester Polytechnic Institute, Worcester, Mass., U.S.A.
1891	Trans.	C. 1894-6- V.P. 1908-	†‖Kipping, Frederic Stanley, Prof., D.Sc. (Lond.), Ph.D. (Munich), F.R.S., F.I.C., University College, Nottingham
1886			Kirby, Herbert Edward, 41, Gordon-square, W.C.
1909			Kirby, Oswald Farquhar, M.A., and B.Sc. (Aberd.), 14, Wellclose-mount, Leeds
1895			‖Kirkaldy, Professor Patrick Henry, F.I.C., Chemical Department, King's College, W.C.
1903			Kirkby, William, M.Sc. (Manc.), Winster House, Thornfield-road, Heaton Moor, Stockport
1889			Kitchin, John, The Middlesex Hospital, W.C.
1888			‖Knaggs, Alfred Battye, 37, Mannville-terrace, Bradford
1889			Knight, Frederick Charles, c/o Garfield Smelting Co., Garfield, Utah, U.S.A.
1903			Knight, Harley Fancut, Ledbury, 64, Amhurst-park, Stamford Hill, N.
1894			Knight, James, M.A. and D.Sc. (Glas.), St. James's Public School, Calton, Glasgow
1896			Knight, John Burnett, Bushwood, Wanstead, Essex
1894			Knight, William Albert, Sexey's Trade School, Bruton, Somerset
1878			Knights, James West, F.I.C., County Laboratory, Cambridge
1879			Knowles, Joshua, Stormer-hill, Tottington, Bury
1864			Knox, George Walter, B.Sc. (Lond.), 16, Finsbury-circus, E.C.
1873			Koch, Walter Edward, M.A., P.O. Box 718, El Paso, Texas, U.S.A.
1887	Trans.		Koga, Yoshimasa, The Imperial Mint, Osaka, Japan
1908			Kohn, Hugo Stefan, Ph.D. (Berlin), 3A, Hythe-road, Willesden Junction, N.W.
1904			Komppa, Gustav, Prof., Ph.D. (Helsingfors), Polytechnik, Helsingfors, Finland
1885			Koningh, Leonard de, F.I.C., 4, St. Martin's-road, Stockwell, S.W.
1892			Krause, Georg, Prof. Dr., Cöthen (Anhalt), Germany
1908			Krishnayya, H. V., B.A. (Madras), Government Chemical Laboratory, Mallesvaram, Bangalore, Mysore
1859	Trans.		Kynaston, Josiah Wyckliffe, F.I.C., Chemical Laboratory, 3, Oak-terrace, Beech-street, Liverpool
1900			Kynaston, William Charles Robert, 9, Harland-road, Higher Tranmere, Birkenhead

† Longstaff Medallist, 1909.

Date of Election.			
1906			Ladell, William Richard Simpson, A.I.C., 19, Alwyne-road, N.
1909			Lakhani, Hassum Alidina, M.D. (Brussels), Murud Janjira, Bombay Presidency, India
1893			Lamb, Edmund George, M.A. (Oxon.), M.P., Borden Wood, Liphook, Hants.
1900			Lamb, Morris Charles, The Leathersellers Technical College, 176, Tower Bridge-road, S.E.
1892	Trans.		‖Lamb, Thornton Charles, Ph.D. (Heidelberg), c/o Messrs. Brunner, Mond and Co., Crescent Wharf, Silvertown, E.
1893			Lambert, Wesley J., Chemical Laboratory, Royal Gun Factory, Woolwich, S.E.
1903	Proc.		Lamplough, Francis Edward Everard, B.A. (Cantab.), Trinity College, Cambridge
1877			Lancaster, William James, F.R.C.S., Pine Crest, Barnt Green, Worcs.
1902			Landau, A. Lionel, Taquah and Abosso Gold Mining Co., Ltd., Tarquah, Gold Coast, W. Africa
1900	Trans.		Lander, George Druce, D.Sc. (Lond. and St. Andrews), F.I.C., Royal Veterinary College, Camden Town, N.W.
1897	Trans.		Lang, William Robert, Prof., D.Sc. (Glas.), F.I.C., The University, Toronto, Canada
1899			Lange, Ernest Frederick Stephen, Fairholm, Willow Bank, Fallowfield, Manchester
1885			Langer, Charles, Ph.D. (Zürich), Ynyspenllwch, Clydach, S.O., Glamorgan
1891			‖Langham, Edgar Norman, Rev., M.A. (Cantab.), Rastrick Grammar School, Brighouse
1894	Trans.	C. 1904-7	Lapworth, Arthur, D.Sc. (Lond.), F.I.C., The University, Manchester
1908			Larmuth, Lionel Gordon, Grove House, Cheadle Hulme, Manchester
1901	Proc.		Larter, Alfred Tabois, B.Sc. (Lond.), 86, Inderwick-road, Stroud Green, N.
1883			Lascelles, Brian Piers, M.A. (Oxon.), Headland, Mount-park, Harrow-on-the-Hill
1901	Trans.		Lattey, Robert Tabor, Trinity College, Oxford
1906			Lattey, William Tabor, Tarmon, Streatham Park, S.W.
1891	Trans.		Lauder, Alexander, D.Sc. (Edin.), Edinburgh and East of Scotland College of Agriculture, 13, George-square, Edinburgh
1886	Trans.		Laurie, Arthur Pillans, Principal, M.A. (Cantab.), D.Sc. (Edin.), F.R.S.E., The Heriot-Watt College, Edinburgh
1876			‖Law, Channell, Ilsham Dene, Torquay
1905	Trans.		Law, Herbert Drake, B.Sc. (Lond.), Borough Polytechnic, 103, Borough-road, S.E.

Date of Election.		
1896		‖Law, Herbert Edward, 636, Pine-street, San Francisco, Cal., U.S.A.
1890	Trans.	‖Law, Robert, F.I.C., The Royal Mint, Melbourne, Australia
1903		Lawrence, Henry William, Johnsonville, Wellington, New Zealand
1900		Laws, Arthur Robert, B.Sc., (Lond.), 90, St. George's-terrace, Newcastle-on-Tyne
1882		Laws, Joseph Parry, F.I.C., Laurel Bank, Claremont-road, Headingley, Leeds
1890	Trans.	‖Laycock, William Frederick, Ph.D., 7, Park-street, Dewsbury
1890		Lea, Arthur Sheridan, M.A. and Sc.D. (Cantab.), F.R.S., Sunnyside, Sidcup, S.O., Kent
1886		‖Leach, Walter, 21, St. Andrew's-place, Bradford
1902		Leader, George Herbert, Montego Bay Secondary School, Montego Bay, Jamaica
1894	Trans.	‖Lean, Bevan, B.A. and D.Sc. (Lond.), Sidcot School, Winscombe, Somerset
1888		Lease, Frank Edward, Sapong Estate, Fort Birch, British North Borneo
1902		Leather, John Petty, Whittier, Colne-road, Burnley, Lancs.
1891	Trans.	Leather, John Walter, Ph.D. (Freiburg), F.I.C., Agricultural Research Institute, Pusa, Bengal, India
1900		‖Leathes, John Beresford, Prof., M.A., M.B. and B.Ch. (Oxon.), F.R.C.S. (Eng.), The University, Toronto, Canada
1889		Ledingham, Laurence Napier, Govandale, Taptonville-crescent, Sheffield
1883		Lee, Herbert Cabry, Thames Ditton Brewery, Thames Ditton, Surrey
1898		Lee, Harry Lancelot, 8, Station-avenue, New Earswick, York
1897	Trans.	Lee, Theophilus Henry, 36, Rua do Ouvidor, Rio de Janeiro, Brazil
1909		Leedham, Joseph, 176, Bromford-lane, West Bromwich
1905		Leek, William Henry, B.A. (Lond.), Elm View, Leigh, Lancs.
1899		Leeming, William Thomas, M.Sc. (Vict.), The Hollins, Hanover-road, Canterbury
1903	Trans.	Lees, Frederic Herbert, Avondale, Green-street-green-road, Dartford, Kent
1891		Leffler, Rudolf, 75, Harcourt-road, Sheffield
1889		‖Legg, John Edmund, M.A. (Cantab.), F.I.C., Cae Rhys, Dorchester-road, Weymouth
1901		Lehmann, Adolf Ludwig Ferdinand, B.Sc. (Toronto), Ph.D. (Leipzig), Agricultural Experiment Station, Wooster, Ohio, U.S.A.

Date of Election.			
1891	Proc.		Leicester, James, Ph.D. (Erlangen), F.I.C., 17, Staverton-road, Oxford
1903			Leigh, Arthur Graham, jun., Chorcliff House, Chorley, Lancs.
1889			Leigh, Cecil, F.I.C., Birmingham Metal and Munitions Co., Ltd., Adderley Park Rolling Mills, Birmingham
1904			Le May, Percy Kent, 6, Lothair-villas, Hatfield, Herts.
1891			Lennox, Robert N., Morvah, Hartington-road, Chiswick, S.W.
1899			Leon, Arthur Alexander, Ray House, Ray-park-road, Maidenhead
1906	Trans.		Le Rossignol, Robert, B.Sc. (Lond.), A.I.C., 2, Caesarea-place, Jersey, Channel Islands
1904			Lessing, Rudolf, Ph.D. (Munich), Southampton House, 317, High Holborn, W.C.
1902			Lessner, Charles B., Carril, Spain
1895	Trans.	C. 1907-	‖Le Sueur, Henry Rondel, D.Sc. (Lond.), F.I.C., St. Thomas's Hospital, S.E.
1899			Lett, Stephen Joshua, Panjaboengan, via Padang, Sumatra (West Coast), Dutch East Indies
1879			Letts, Edmund Albert, Prof., Hon. D.Sc. (R.U.I.), Ph.D. (Göttingen), F.I.C., Queen's College, Belfast
1904			Levy, Arthur Garfield, B.Sc. (Lond.), F.I.C., c/o B. Blount, Esq., F.I.C., 76, York-street, Westminster, S.W.
1903			Levy, Henry Wolff, 423B, Little Collins-street, Melbourne, Australia
1909	Trans.		Levy, Leonard Angelo, B.A. (Cantab.), B.Sc. (Lond.), 60, Priory-road, West Hampstead, N.W.
1888	Trans.		Lewes, Vivian Byam, Prof., F.I.C., 30, Croom's-hill, Greenwich, S.E.
1907			Lewis, Carl, c/o Messrs. Lennon, Ltd., Oxford-street, East London, Cape Colony, S. Africa
1899	Trans.		Lewis, Edward Watkin, Hollycroft, Loughton, Essex
1901			Lewis, Ernest Alfred, 310, Dudley-road, Birmingham
1894	Trans.		Lewis, William Henry, M.A. (Oxon.), F.I.C., 27, St. Leonard's-road, Exeter
1869	Trans.		‖Lewis, William James, Prof., M.A. (Oxon. and Cantab.), F.R.S., New Museums, Cambridge
1888	Trans.	C. 1902-03	‖Lewkowitsch, Julius, M.A. and Ph.D. (Breslau), F.I.C., 71, Priory-road, West Hampstead, N.W.
1878			‖Lichtenstein, Theodore David, F.I.C., Chemical Works, Silvertown, E.
1896			Lidgey, Cecil Rudolf, 50a, Forest Hill-road, East Dulwich, S.E.
1900			Liebmann, Adolf, M.A. and Ph.D. (Bonn), 16, Darley-avenue, West Didsbury, Manchester

Date of Election			
1908			Linch, Frank William, A.I.C., 9, Gladstone-avenue, Manor Park, E.
1903			Linday, John Howard, c/o Messrs. John Robinson and Co., Ltd., Oil Seed Crushers, Redcliffe-parade, Bristol
1901			Linde, Harold Theodor Granville van der, c/o Continental Rubber Co., 111, Broadway, New York City, U.S.A.
1908			Lindley, Arthur Stanley, Laboratory, Prince-building, Medows-street, Bombay, India
1899			Lindsey, Robert William, 14, Hilldrop-road, Camden-road, N.
1886	Trans.		Ling, Arthur Robert, F.I.C., 74, Great Tower-street, E.C.
1899			Linstead, Edward Flatman, 15, Station-avenue, Winchmore Hill, N.
1902			Liotard, Ernest, 2, Rue de France, Nice, France
1905			Lister, Joseph, B.Sc. (Lond.), A.R.C.S., Chemisches Laboratorium, (Parb I.), Liebigstrasse 18, Leipzig, Germany
1853	Trans.	V.P. 1883-7, 1898-1901.	‖Liveing, George Downing, Emeritus Prof., M.A. (Cantab.), Hon. Sc.D. (Cantab. & Dub.), F.R.S., F.I.C., The Pightle, Cambridge
1872	Trans.		‖Liversidge, Archibald, Prof. M.A. (Cantab.), Hon. LL.D. (Glas.), A.R.S.M., F.R.S., F.I.C., Hornton Cottage, Hornton-street, Kensington, W.
1903			Livesey, Charles Edwin Leonard, B.Sc. (Vict.), Stonyhurst College, Blackburn, Lancs.
1883			Livingston, William John, F.I.C., London County Council, Spring-gardens, S.W.
1909			Livsey, Harry, 54, Pemberton-street, Old Trafford, Manchester
1880			‖Lloyd, Alfred, The Dome, Bognor, Sussex
1876	Trans.		Lloyd, Frederick James, F.I.C., Muscovy House, 6, Trinity-square, E.C.
1905			Lloyd, George Moss, M.A. (Vict.), M.Sc. (L'pool), The Limes, 7, Pepys-road, Raynes Park, S.W.
1907			Lloyd, Percival George, Kelvinside, Lower Ham-road, Kingston-on-Thames
1896			Lloyd, Thomas Henry, c/o Messrs. Quibell Bros., Ltd., Newark-on-Trent
1900			Lockhart, Thomas Lamb, Glencairn Main Reef Gold Mining Co., Ltd., P.O. Box 191, Germiston, Transvaal, S. Africa
1902			Lockitt, Charles Henry, B.A. (Lond.), Rectory Cottage, Solihull, Birmingham
1902			Logan, Thomas Stratford, The Colony, Ewell, Surrey
1884			London, John Edward, M.D. (Dun.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), 62, Main-street, Georgetown, Demerara, W. Indies
1872			‖Longstaff, George Blundell, M.A. and M.D. (Oxon.), F.R.C.P., (Lond.), M.R.C.S. (Eng.), Highlands, Putney Heath, S.W.
1904			Longstaff, James Patrick, D.Sc. (Edin.), 17, Fettes-row, Edinburgh

Date of Election.		
1873		‖Loram, Herbert Yabsley, F.I.C., 49, Buxton-road, Chingford, Essex
1878	Trans.	‖Louis, David Alexander, F.I.C., 77, Shirland-gardens, Maida Vale, W.
1882		Love, Edward Gurley, Ph.D. (Columbia), 80, East 55th-street, New York City, U.S.A.
1882		‖Lovibond, Thomas Watson, F.I.C., West Jesmond House, Newcastle-on-Tyne
1884		‖Low, Charles William, M.B. (Dun.), M.R.C.S. (Eng.), L.R.C.P. and D.P.H. Lond.), Stricklands, Stowmarket, Suffolk
1904	Trans.	Lowe, Frank Harold, M.Sc. (Vict.), South-Western Polytechnic, Manresa-road, Chelsea, S.W.
1878		‖Lowe, Walter Bezant, M.A. (Cantab.), Cae Carw, Llanfairfechan, N. Wales
1876		Lowe, William Foulkes, A.R.S.M., F.I.C., 9, Hough-green, Chester
1898	Trans.	‖Lowry, Thomas Martin, D.Sc. (Lond.), 130, Horseferry-road, Westminster, S.W.
1901		Lowson, William, B.Sc. (Lond. and Leeds), F.I.C., The University, Leeds
1899		Lucas, Alfred, F.I.C., Survey Department, Finance Ministry, Giza, Egypt
1905		Lucas, Edward William, F.I.C., 2, Hills-place, Oxford-street, W.
1902		Lucas, Harry, The South of England College of Pharmacy, 186, Clapham-road, S.W.
1905		Luck, Alfred Courtenay, Laboratorio de Polvoras, Ministerio de Marina, Darsena Norte, Buenos Ayres, Argentine, S. America
1902	Trans.	Ludlam, Ernest Bowman, D.Sc. (L'pool), M.Sc. (Vict.), College-gate, College-road, Clifton, Bristol
1891		Ludlow, Lionel, Standard Bank of South Africa, Bulawayo, Rhodesia, S. Africa ; and Southville, Swansea.
1877	Trans.	‖Luff, Arthur Pearson, M.D., B.Sc., F.R.C.P. and L.S.A. (Lond.), M.R.C.S. (Eng.), D.P.H. (Glas.), F.I.C., 9, Queen Anne-street, Cavendish-square, W.
1890	Trans.	Lumsden, John Scott, D.Sc. (St. Andrews), Ph.D. (Munich), 9, Rosewood-terrace, West Park, Dundee
1907		Lunan, George, 50, Garscube-terrace, Murrayfield, Edinburgh
1872	Trans.	‖Lupton, Sydney, 102, Park-street, Grosvenor-square, W.
1893	Trans.	Luxmoore, Charles Mann, D.Sc. (Lond.), F.I.C., Central Technical Schools for Cornwall, and 13, Treyen-road, Truro
1899		Luxton, Thomas, B.A. and B.Sc. (Lond.), 116, North Boulevard, Hull
1908		Lyell, Henry Robert, Redcot, Dacres-road, Sydenham, S.E.
1908		Lynch, Gerald Roche, 160, Holland-park-avenue, W.

Date of Election.		
1873		Lyon, Isidore Bernadotte, Brigade Surgeon, Lieut.-Col., C.I.E., M.R.C.S. (Eng.), F.I.C., East India U.S. Club, 16, St. James's-square, S.W.; and 164, Sutherland-avenue, W.
1874		Lyon, John George, F.I.C., The Aire Tar Works, Knottingley, Yorks.
1905		Lyon, Rudolf, 400, Huddersfield-road, Halifax
1886	Trans.	Lyons, Albert Brown, A.M., M.D., 72, Brainard-street, Detroit, Mich., U.S.A.
1888		Maben, Thomas, 20, Great Pulteney-street, W.
1896		Macadam, Herbert Edwin, Odam's Wharf, Victoria Docks, E.
1888		‖Macadam, Stevenson John Charles George, F.I.C., Analytical Laboratory, 55, York-place, Edinburgh
1899		McAlley, James, Bankside Cottage, Falkirk, N.B.
1900		Macara, Thomas, F.I.C., c/o Messrs. Lipton's, Ltd., Rouel-road, Bermondsey, S.E.
1887		‖McArthur, John, F.R.S.E., 262, Trinity-road, Wandsworth Common, S.W.
1890		‖MacArthur, John Stewart, 74, York-street, Glasgow
1888		McBretney, Edmund George, F.I.C., 23, Ferrybridge-road, Castleford, Yorks.
1900		McCall, William, 8, Beaton-road, Maxwell-park, Glasgow
1902		MacCallum, Douglas Archibald, Central-chambers, 93, Hope-street, Glasgow
1905		McCleary, William, 61, Station-road, Pendlebury, near Manchester
1899		McClumpha, Robert, 372, Westgate-road, Newcastle-on-Tyne
1906	Trans.	McCombie, Hamilton, M.A. (Aberd.), B.Sc. (Lond.), Ph.D. (Strassburg), A.R.C.S., F.I.C., The University, Birmingham
1907	Trans.	McConnan, James, D.Sc. (L'pool), M.Sc. (Vict.), Ph.D. (Jena), Frigorifico, Campana, F.C.R., Argentine, S. America
1904		McCourt, Cyril Douglas, A.C.G.I., 13, Malwood-road, Balham Hill, S.W.
1875		‖McCowan, William, F.I.C., Essex Wharf, Narrow-street, Limehouse, E.
1899		McCracken, James, Ballantrae, Roxburgh-circus, Cardonald, N.B.
1896	Trans.	McCrae, John, jun., Ph.D. (Heidelberg), F.I.C., Government Laboratories, P.O. Box 1080, Johannesburg, S. Africa
1899		McCreath, William Dunlop, Quantock Vale Cider Co., Ltd., North Petherton, Bridgwater
1890		‖McCubbin, William Alexander, F.I.C., May Cottage, Neston, Cheshire
1897		MacCulloch, Charles, Auckland Club, Auckland, New Zealand

Date of Election.		
1894		McCutcheon, James, Meniehaus, Woodend-drive, Jordanhill, Glasgow
1903		Macdonald, David Baird, 82, Hinckley-road, Leicester
1901		Macdonald, F. G., Durban Roodeport Gold Mining Co., Ltd., P.O. Box 111, Roodeport, Transvaal, S. Africa
1894	Trans.	MacDonald, George William, M.Sc. (Melbourne), Geddes House, Burch-road, Gravesend
1906		Macdonald, Thomas, c/o Indian Fisheries Co., Cochin, Southern India
1891		MacDonald, William, A.R.C.S., A.R.S.M., F.I.C., Assistant Postal Secretary, Peking, China
1904		McDougall, Arthur Thomas, B.A. (Lond.), Beaufort Cottage, Wellington-road, Bow, E.
1874		McDougall, John, Clifton House, Greenwich Park, S.E.
1906		McDowall, John, c/o H. Monson, Esq., Sabaieh, Upper Egypt
1906		Mace, William Ethrington, Box 662, General Post Office, Montreal, Canada
1886		MacEwan, Peter, 64, Southwood-lane, Highgate, N.
1898		McEwen, Antholl Francis, Nova Scotia Mine, Box 525, Cobalt, Ontario, Canada
1895		MacFarlane, Alexander, Loch Sloy, Polefield, Blackley, Manchester
1891		Macfie, Robert Andrew Scott, M.A. (Cantab.), B.Sc. (Edin.), 34, Moorfields, Liverpool
1909		McGillvray, John Esson, M.A. (Edin.), Henry Smith School, Hartlepool
1895		McGlashan, John, Cawnpore Sugar Works, Cawnpore, India
1887	Trans.	McGowan, George, Ph.D. (Leipzig), F.I.C., 21, Montpelier-road, Ealing, W.
1908		MacGregor, Gregor, M.A. and B.Sc. (Glas.), Giffen-park, Dysart, Fife, N.B.
1893		McGregory, Joseph Frank, Prof., Colgate University, Hamilton, N. Y., U.S.A.
1906		McIntosh, David, Stamford School, Stamford, Lincs.
1890		Macintyre, Alfred Edgar, Ph.D., The Chemical Laboratory, Dominion Arsenal, Quebec, Canada
1877		‖Mackay, Angus, 40, Bath-street, Portobello, N.B.
1890		Mackean, William, 208, Bedford-hill, Balham, S.W.
1905		MacKechnie, Robert Drysdale, Minas de Rio Tinto, Provincia de Huelva, Spain
1901	Trans.	McKenzie, Alexander, M.A. and D.Sc. (St. Andrews), Ph.D. (Berlin), Birkbeck College, Bream's Buildings, Chancery-lane, E.C.

Date of Election.			
1897	Trans.		Mackenzie, John Edwin, D.Sc. (Edin.), Ph.D. (Strassburg), 11, Ramsay-gardens, Edinburgh
1902			Mackenzie, John Ross, Worcester Brewery, Worcester
1899			‖Mackenzie, Thomas, 4, Church-street, Inverness
1900			Mackenzie, Thomas Ebenezer, The Capillitas Copper Co., Ltd., Pilciao, Provincia de Catamarca, Argentine, S. America
1893			McKerrow, Charles Alexander, Wingfield, Wilmslow, Cheshire
1892			McKerrow, William James, D.Sc. (Tübingen), F.I.C., 12, Chadwick-road, Leytonstone, N.E.
1897			Maclaurin, James Scott, D.Sc. (N.Z.), Wellington, New Zealand
1868	Trans.	C. 1871-4, 80-4, 95-9. V.P. 1887-90, 1901-04	‖McLeod, Herbert, Prof., Hon. LL.D. (St. Andrews), F.R.S., 37, Montague-road, Richmond, Surrey
1899			McLeod, James, F.I.C., Gas Works, Greenock, N.B.
1903			MacMahon, Frederick William, 31, Marler-road, Forest Hill, S.E.
1879			‖Macmillan, James Laker, 98, Phillip-street, Sydney, N.S.W.
1897			Macmullen, Alan, B.A. (Oxon.), The Manor House, Raheny, S.O., Co. Dublin
1881			MacMunn, Charles Alexander, M.A. and M.D. (Dub.), L.R.C.S. (Ireland), Oakleigh, Wolverhampton
1889	Trans.		‖McMurtry, George Cannon, A.R.S.M., A.R.C.S., Mount-street, Nelson; and c/o Maoriland Copper Co., Ltd., Richmond, Nelson, New Zealand
1880			Macnab, William, F.I.C., 10, Cromwell-crescent, S.W.
1885	Trans.		‖Macnair, Duncan Scott, Ph.D. (Würzburg), B.Sc. (Lond.), 67, Braid-avenue, Edinburgh
1899			Main, Hugh, B.Sc. (Lond.), Almondale, Buckingham-road, South Woodford, N.E.
1900			Mair, William, 7, Comiston-road, Edinburgh
1902	Trans.		Maitland, William, D.Sc. (Aberd.), Birkbeck College, Breams-buildings, Chancery-lane, E.C.
1892			Major, George Harry, Devonshire-street, Ardwick, Manchester
1906			Majumdar, Tarak Nath, 37, Lower Chitpore-road, Calcutta, India
1894			Makin, Charles James Shaw, F.I.C., Thorn Bank, Leamington
1885	Trans.		‖Mallet, Frederic Richard, F.I.C., 20, King's-avenue, Ealing, W.
1857	Trans.	V.P. 1888-91	Mallet, John William, Prof., Ph.D. (Göttingen), M.D. (Louisiana), LL.D. (Princetown, Pennsylvania, and Johns Hopkins), F.R.S., University of Virginia, Albemarle Co., Va., U.S.A.
1897			Mallinson, Willie Lee, Gawthorp-green, Kirkheaton, near Huddersfield
1904			Mander, Alfred, Berkswell, Malvern

Date of Election.			
1903			Mander, Percy George, B.Sc. (Lond.), The Grammar School, Doncaster
1903			Mann, Ernest William, Lyndale, Northfield-road, King's Norton, Birmingham
1903			Mann, John Christopher, 33, Nicholls-street, West Bromwich
1902			Mann, William, B.Sc. (Lond.), 84, Inchmery-road, Catford, S.E.
1896			Manners, Hugh, M.A. and B.Sc. (Glas.), Academy House, Airdrie, N.B.
1908			Mansfield, Herbert, B.Sc. (Lond.), A.I.C., 70, Stapleton-hall-road, Stroud Green, N.
1897			Mansford, Charles John Jodrell, B.A. (Lond.), The Grammar School, Dartford, Kent
1895			‖Marchant, Robert Charles, Walnut Tree Cottage, Andover
1905	Trans.		Marle, Ernest Robert, B.Sc. (Lond.), A.R.C.S., Hartley University College, Southampton
1907	Trans.		Marsden, Herbert, B.Sc. (Manc.), Bramford, Ipswich
1895			Marsden, Prosper Henry, The Royal Infirmary, Liverpool
1883	Trans.	C. 1902-7	‖Marsh, James Ernest, M.A. (Oxon.), F.R.S., University Museum, Oxford
1895	Trans.		Marshall, Arthur, A.C.G.I., F.I.C., Chief Chemical Examiner, Naina Tal, India
1907			Marshall, Hubert Frederick Sankey, c/o Messrs. Robert Stephenson & Son, Ltd., Burwell, Cambridge
1890	Trans.		Marshall, Hugh, Prof., D.Sc. (Edin.), F.R.S., University College, Dundee
1896			Marshall, Percy Sykes, Union Laboratory, Half Moon-street, Huddersfield
1891			Marshall, Reginald Tom, Kingscote, Upper Lenham-road, Sutton, Surrey.
1887			‖Marshall, William, F.I.C., Laboratory, Ladybrook-road, Cheadle Hulme, Stockport
1897			Martin, Charles Henry, 40, Bolton-road, Pendleton, Salford
1902			Martin, Francis, 3, York-terrace, Eglinton-road, Plumstead, S.E.
1905			Martin, Francis Grimshaw, 1, Harbury-road, Birmingham
1906			Martin, Frederick James, 6, Lamb-park-terrace, Par, Cornwall
1907			Martin, Gerald Hargrave, 3A, Church-road, Upper Norwood, S.E.
1906			Martin, George Frederick Wesley, 14, Castle-park, Lancaster
1898	Trans.		‖Martin, George Herbert, M.A. (Oxon.), The Grammar School, Bradford, Yorks.
1885			‖Martin, Gerald Ward, Lieut.-Col., 8, Petersham-terrace, Gloucester-road, S.W.

Date of Election.			
1907			Martin, Joseph, B.Sc. (Dun.), 25, Vernon-road, Leytonstone, E.
1901			Martin, Nicholas Henry, Ravenswood, Low Fell, Gateshead-on-Tyne
1909			Martin, William George, B.Sc. (Wales), Royal School, Armagh, Ireland
1902			Martindale, William Harrison, Ph.D. (Marburg), 10, New Cavendish-street, W.
1871			‖Martineau, George, 21, Mincing-lane, E.C.; and Gomshall Lodge, Gomshall, Surrey
1887			‖Martineau, Sydney, Streatham-grove, Norwood, S.E.
1898			Mascarenhas, John Charles, 66, Wynndale-road, South Woodford, Essex
1851	Trans.	C. 1858-9, 75-7 V.P. 78-81	Maskelyne, Mervyn Herbert Nevil Story, M.A. and Hon. D.Sc. (Oxon.), F.R.S., F.I.C., Salthrop, Wroughton, Wilts.
1905			Mason, Arthur Walter, B.Sc. (Lond.), Norvic, Windsor-gardens, North Shields
1890			Mason, Francis Herbert, P.O. Box 31, Paso Robles, Cal., U.S.A.
1882	Trans.		Masson, David Orme, Prof., M.A. and D.Sc. (Edin.), F.R.S., The University, Melbourne, Australia
1897			Masters, Edward, Rock Mount, 186, Hinckley-road, Leicester
1873			‖Masters, William, St. Erme, The Hall-road, Cheltenham
1906			Mastin, John, Woodleigh House, Totley Brook, near Sheffield
1904			Mathews, Harold Joseph Clarke, Massey's Burnley Brewery, Ltd., Burnley, Lancs.
1909			Matchett, Andrew Sneddon, 13, Bute-gardens, Cathcart, N.B.
1902			Mathieson, Robert, J.P., Rill Bank, Innerleithen, Peeblesshire
1876	Trans.		‖Matthews, Charles George, F.I.C., Abendberg, 31, Stapenhill-road, Burton-on-Trent
1907			Matthews, Charles Pask, B.Sc. (Lond.), A.I.C., Tiffin's Boys School, Kingston-on-Thames
1880	Trans.	C. 1906-09	‖Matthews, Francis Edward, Ph.D. (Göttingen), F.I.C., Ash Lawn, The Glebe, Blackheath, S.E.
1884			‖Matthey, Edward, Col., C.B., A.R.S.M., 31a, Weymouth-street, W.
1870		C. 1877-9	Matthey, George, Assoc. Inst. C.E., F.R.S., 78, Hatton-garden, E.C.
1893			‖Mawer, William Frederick, 332, Kennington-road, S.E.
1865			‖Maxwell, Theodore, B.A. and M.D. (Cantab.), F.R.C.S. (Edin.), B.Sc. (Lond.), 29, Woolwich Common, S.E.
1909			May, Percy, 126, Cazenose-road, Stamford Hill, N.
1909			May, Rowland Josiah, Granaugh Villa, Dunbar, N.B.
1908			Maywald, Frederick John, 89, Pine-street, New York City, U.S.A.

Date of Election.			
1892			Meacham, Charles Stephen, c/o Messrs. Ohlsson's Cape Breweries, Ltd., Newlands, Cape Town, S. Africa
1908			Meade, Alwyne Harcourt, Cedar House, St. Neots
1898			Meads, Charles James, Plesaunce, West-cliff-road, Roker, Sunderland
1904			Mears, Francis D'Oyley, jun., 31, Rawdon-place, Cardiff
1901	Trans.		Mees, Charles Edward Kenneth, D.Sc. (Lond.), 76, Canterbury-road, Croydon
1908			Meggitt, Alfred Ash, B.Sc. (Lond.), Government of Eastern Bengal and Assam, Dacca, Eastern Bengal, India
1896			Meggitt, Loxley, F.I.C., c/o C.W.S., Ltd., Wheatsheaf Works, Alexandria, Sydney, N.S.W.
1871	Trans.	C. 1883-7, 90-91 F.S. 1891-1902 V.P. 1902-05 P. 1905-7	‖Meldola, Raphael, Prof., F.R.S., F.I.C., Finsbury Technical College, Leonard-street, E.C. ; and 6, Brunswick-square, W.C.
1905	Trans.		Meldrum, Andrew Norman, D.Sc. (Aberd.), Chemical Department, The University, Manchester
1894			Melland, Godfrey, M.Sc. (Vict.), A.R.S.M., F.I.C., Chemical Department, The Polytechnic, Woolwich, S.E.
1908			Melling, Samuel Ernest, F.I.C., The Cliff, Higher Broughton, Manchester
1902	Trans.		Mellor, Joseph William, D.Sc. (N.Z.), The Villas, Stoke-on-Trent
1875			‖Melmore, Pattinson Banks, Chemical Laboratory, Maryport
1902			Mence, George Augustus Henry, B.Sc. (Lond.), The Grammar School, Lincoln
1900	Proc.		Menzies, Alan Wilfrid Cranbrook, M.A. and B.Sc. (Edin.), Kent Chemical Laboratory, The University, Chicago, Ill., U.S.A.
1908			Menzies, Frederick Norton Kay, M.D., B.S. and F.R.C.P. (Edin.), D.P.H. (R.C.P.S. Lond.), 79, Davies-street, Berkeley-square, W.
1889			Mercer, Thomas, F.I.C., Devonshire Club, Eastbourne
1901			Meredith, William, 63, Albion-place, Ulverston, Lancs.
1896			Merrett, William Henry, A.R.S.M., F.I.C., Hatherley, Grosvenor-road, Wallington, Surrey
1908			Merrick, Arnold, 66, Rothbury-terrace, Newcastle-on-Tyne
1891			Merrils, Frederick Johnson, Haxworth-chambers, 25, Figtree-lane, Sheffield
1897			Merson, George Fowlie, 7, King-street, Kilmarnock, N.B.
1876	Trans.	C. 1884-8, 1897-1901 V.P. 1906-9	‖Messel, Rudolph, Ph.D. (Tübingen), 147, Victoria-street, Westminster, S.W.

Date of Election.			
1909			Metzger, Floyd Jay, Columbia University, New York City, U.S.A.
1900			Meyer, Hans, Ph.D., 1, Salmgasse, Prague, Bohemia
1904			Middleditch, Bernard, B.A. (Cantab.), Woodcroft, Harrow-on-the-Hill
1906			Middleton, Alexander Edmund, Government Laboratory, Clement's Inn-passage, Strand, W.C.
1888	Trans.	V.P. 1901-04	‖Miers, Henry Alexander, Principal, M.A. and D.Sc. (Oxon.), F.R.S., 23, Wetherby-gardens, S.W.
1908			Miles, William Herbert, 3, Liversidge-road, Higher Tranmere, Birkenhead
1908			Millar, Charles James, c/o Messrs Turner, Morrison & Co., 6, Lyons-range, Calcutta, India
1892	Trans.		Millar, James Hill, D.Sc. (Birm.), F.I.C., 2, Kerrymount-avenue, Foxrock, Co. Dublin.
1891			‖Millard, Edgar James, 35–42, Charlotte-street, Great Eastern-street, E.C.
1905			Millen, John Dunlop, Mount Bischoff Mine, Waratah, Tasmania
1880	Trans.		‖Miller, Alexander Kenneth, Ph.D. (Würzburg), F.I.C., Kilvert's-buildings, Withy-grove, Manchester
1901			Miller, Edward Holl, c/o Anglo Australian Milk Co., Clydebank, Sale, Victoria, Australia
1889	Trans.		Miller, James Bruce, A.I.C., Rubislaw Den North, Aberdeen
1887			Miller, John A., M.Sc. (Illinois), Ph.D. (Berlin), 44 & 45, Lewis Block, Buffalo, N.Y., U.S.A.
1885	Trans.		‖Miller, Norman Harry John, Ph.D. (Würzburg), F.I.C., Harpenden, Herts.
1898			Miller, William Lash, B.A. (Toronto), Ph.D. (Munich), 50, St. Alban-street, Toronto, Canada
1893	Trans.		‖Mills, Charles, F.I.C., P.O. Box 112, Kroonstad, S. Africa
1862	Trans.	C. 1868-72, 75-6, 80-4, 1903-06	‖Mills, Edmund James, Prof., D.Sc. (Lond.), LL.D. (Glas.), F.R.S., F.I.C., 64, Twyford-avenue, West Acton, W.
1906			Mills, Herbert Arthur, 3, Croxted-road, West Dulwich, S.E.
1898	Trans.		Mills, William Hobson, M.A. (Cantab.), Sc.D. (Tübingen), The Northern Polytechnic Institute, Holloway, N.
1905	Trans.		Mills, William Sloan, M.A., D.Sc. and B.E. (R.U.I.), Chemical Dept., The Polytechnic, Woolwich, S.E..
1885			‖Milne, Alexander, Lieut.-Col. I.M.S., M.A., M.B. and M.Ch. (Aberd.), H.M.'s Mint, Bombay, India
1908			Minett, Edward Pigott, M.D. (Brussels), M.R.C.S. (Eng.), L.R.C.P. (Lond.), Guys Hospital, S.E.
1887			Mingaye, John Charles Henderson, F.I.C., Department of Mines, Assay Branch, Sydney, N.S.W.

Date of Election.			
1898			‖Mitchell, Albert Henry, B.Sc. (Lond.), F.I.C., Borough Analyst's Laboratory, 10, Morley-terrace, Tiverton, Devon
1907	Trans.		Mitchell, Herbert Victor, 26, Brookfield-avenue, Walthamstow, N.E.
1905			‖Modi, Edalji Manekji, D.Sc. (N. Carolina), LL.D. (Tennessee), Litt.D. (Providence, Ohio), Opposite Grant-road-station, Sleater-road, Bombay, India
1899			Mohr, Bernard, Ph.D. (Heidelberg), 69A, Parliament-hill, Hampstead, N.W.
1901	Trans.		Moir, James, M.A., D.Sc. (Aberd.), Chemical Laboratory, Mines Department, Winchester House, Johannesburg, S. Africa
1893			Mole, Herbert Bloome, The Croft, Shepton Mallet
1902			Molesworth, Francis Hylton, Jersey-road, Artarmon, Sydney, N.S.W.
1899			Molson, John Cavendish, M.D. (Chicago), L.R.C.P. (Lond.), 17, Vernon-terrace, Brighton
1899			Mond, Emile Schweich, 22, Hyde-park-square, W.
1872	Trans.	C. 1885-6 V.P. 87-90, 94-8	‖Mond, Ludwig, Hon. D.Sc. (Vict. and Oxon.), Hon. Ph.D. (Heidelberg), F.R.S., F.I.C., The Poplars, 20, Avenue-road, Regent's Park, N.W.
1892			Mond, Robert Ludwig, M.A. (Cantab.), F.R.S.E., The Poplars, 20, Avenue-road, Regent's Park, N.W.
1879			‖Mondy, Edmund Felix, A.R.S.M., Dacca, 96, Huron-road, Balham, S.W.
1903	Trans.		Monier-Williams, Gordon Wickham, M.A. (Oxon.), Ph.D. (Freiburg), A.I.C., The Lammas, Esher, Surrey
1904			Montgomery, Jack Percival, Ph.D. (Virginia), A.M. (Clarksville), Agricultural College, Starkville, Miss., U.S.A.
1887	Trans.	C. 1899-1901 1905-8	‖Moody, Gerald Tattersall, D.Sc. (Lond.), F.I.C., Lorne House, North Dulwich, S.E.
1897			Moon, Philip George Gregory, Hillcroft, Alexandra-road, Upper Parkstone, Dorset
1892			‖Moor, Cresacre George, M.A. (Cantab.), F.I.C., Savoy House, 115, Strand, W.C.
1903			Moore, Alfred Ernest, B.A. and B.Sc. (Lond.), Escuela Normal Regional, Corrientes, Argentine, S. America
1903			Moore, Arthur, 128, Felbrigge-road, Goodmayes, Essex
1905	Trans.		Moore, Charles Watson, M.Sc. (Vict.), Ph.D. (Munich), The Wellcome Chemical Research Laboratory, 6, King-street, Snow-hill, E.C.
1891			Moore, Frederick Herbert, 39, Lime-street, E.C.
1907			Moore, John Edward Langford, Walton Cottage, Loughboro'-park, S.W.
1902			Moore, Thomas Henry, c/o Messrs. Burroughs, Wellcome & Co., 45, Lafayette-street, New York, U.S.A.

Date of Election.			
1904	Trans.		Moore, Tom Sidney, M.A. (Oxon.), B.Sc. (Lond.), Magdalen College, Oxford
1908			Morewood, Capel Darcy, Ferndale, Frodingham, Doncaster
1895			Morgan, David James, M.A., M.D. and B.C. (Cantab.), D.P.H. (Lond.), Medical Officer of Health, Swansea
1897			Morgan, Frederick Filmer de, 57, Woodberry-crescent, Muswell Hill, N.
1898	Trans.	C. 1909-	‖Morgan, Gilbert Thomas, D.Sc. (Lond.), A.R.C.S., F.I.C., Royal College of Science, South Kensington, S.W.; and 15, Fawcett-street, Redcliffe-gardens, S.W.
1908			Morgan, Howard Houlston, B.Sc. (Lond.), A.R.C.S., Technical College, Auckland, New Zealand
1888			‖Morgan, John James, F.I.C., Brookside, Harrington, Cumberland
1900			Morgan, John Livingston Rutgers, Prof., A.M., Ph.D. (Leipzig), B.Sc., Columbia University, New York, U.S.A.
1880	Trans.		Moritz, Edward Ralph, Ph.D. (Göttingen), F.I.C., 45, Great Tower-street, E.C.
1879	Trans.	C.1887-90, 96-1900	‖Morley, Henry Forster, M.A. and D.Sc. (Lond.), F.I.C., 5, Lyndhurst-road, South Hampstead, N.W.
1909			Morley, William Norton, B.Sc. (Lond.), 325, Brownhill-road, Catford, S.E.
1895	Trans.		‖Morrell, Robert Selby, M.A. (Cantab.), Ph.D. (Würzburg), c/o Messrs. Mander Bros., Wolverhampton; and South Bank, Compton, Wolverhampton
1892			Morris, Albert, B.A. and B.Sc. (Lond.), Fern Bank, Ashton-under-Lyne
1890			Morris, Arthur Higgs, 72, Chorley-new-road, Bolton, Lancs.
1900			Morris, Edgar Ford, M.A. (Oxon.), c/o Cornbrook Chemical Co., Ltd., Newbridge Mills, Stockport, Cheshire
1905			Morris, Eric Haydn, 44, Rua Nova de Fransisco de Paula 4, Pampulha, Lisbon, Portugal
1891			Morris, Joseph, Ph.D., Fern Bank, 8, Boardman-street, Eccles, Manchester
1905			Mortimer, Alfred, B.A. (Oxon.), Wolverley School, Kidderminster
1872			Morton, Edward Handfield, 88, Wigmore-street, W.
1893			Morton, Frederick, Chemical Works, Milnsbridge, Huddersfield
1890	Trans.		Mosenthal, Henry de, F.I.C., 220, Winchester-house, Old Broad-street, E.C.
1896			Moss, Francis Ambrose, Kalgurli Gold Mines, Ltd, Kalgoorlie, Western Australia
1871			‖Moss, Richard Jackson, F.I.C., St. Aubyns, Ballybrack, Co. Dublin
1898			Moss, William Edward, 2, Windermere-terrace, Princes-park, Liverpool

Date of Election.			
1905			Motion, John, c/o The Joseph Dixon Crucible Co., Jersey City, N.J., U.S.A.
1886			‖Moul, Frank, F.I.C., 5, Blakesley-avenue, Ealing, W.
1884			‖Moyle, Robert Edward, M.A. (Oxon.), Heightley, Chudleigh, S. Devon
1902			Müller, Christian, 6, Baronsfield-road, East Twickenham, Middlesex
1859	Trans.	C. 1863-6 F.S. 69-85 P. 85-7	‖Müller, Hugo, Ph.D. (Göttingen), LL.D. (St. Andrews), F.R.S., 13, Park-square East, Regent's Park, N.W.
1909	Trans.		Müller, Robert, Royal College of Science, South Kensington, S.W.
1871	Trans.	C. 1890-4	‖Muir, Matthew Moncrieff Pattison, M.A. (Cantab.), Gonville and Caius College, Cambridge
1870			‖Muirhead, Alexander, D.Sc. (Lond.), F.R.S., The Lodge, Shortlands, Kent
1906			Mukerjee, Ram Chandra, Prof., B.A., Maharaja's College, Jaipur, Rajputana, India
1907			Mummery, Charles Samuel, Central Technical College, South Kensington, S.W.
1906			Mummery, William Rest, F.I.C., c/o Hygienic Dairy Society, Ltd., Salisbury
1893	Proc.		Munby, Alan Edward, M.A. (Cantab.), Royal Societies' Club, St. James'-street, S.W.
1902			Mundey, Alfred Holley, 14, Wrottesley-road, Plumstead, Kent
1876	Trans.		Munro, John May Herbert, D.Sc. (Lond.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), F.I.C., 12, Grosvenor-place, Bath
1888			Munroe, Charles Edward, Prof., George Washington University, Washington, D.C., U.S.A.
1900			Munton, Frederick Thomas, The Oak House, Winsford, Cheshire
1907			Murgatroyd, Louis, 1, Carlton-drive, Heaton, Bradford
1901			Murphy, Albert John, 28, Great George-street, Leeds
1904			Murray, Benjamin Lindley, A.M. (Columbia), B.S. (Michigan), 19, University-place, New York, U.S.A.
1894			Murray, John Moore, M.Sc. (Vict.), 11, Winmarleigh-street, Warrington
1906			Murray, Thomas Jenkins, M.Sc. (Birm.), Ph.D. (Leipzig) The University, Birmingham
1890	Trans.		‖Murray, Thomas Smith, D.Sc. (Edin.), 1, Nelson-street, Dundee
1869			‖Muspratt, Edmund Knowles, Hon. LL.D. (L'pool), F.I.C., Seaforth Hall, near Liverpool
1873			‖Muspratt, Sidney Knowles, 9, Church-street, Flint, N. Wales
1896			Muter, Alexander Henry Mitchell, F.I.C., Laboratory, 325, Kennington-road, S.E.; and The Châtelet, Horley, Surrey
1870	Trans.		‖Muter, John, Ph.D. (Rostock), F.I.C., Laboratory, 325, Kennington-road, S.E.; and The Châtelet, Horley, Surrey

Date of Election.		
1892	Trans.	Myers, William Shields, D.Sc. (N.J.), 71, Nassau-street, New York City, U.S.A.
1887		Nagel, David Henry, M.A. (Oxon.), Trinity College, Oxford
1903		Nairne, Urban Orlando Scotchburn, 7, Hawthorne-terrace, Ripple-road, Barking, Essex
1874		‖Napier, Arthur S., Prof., B.Sc., c/o Herren Mayer and Müller, 2, Prinz Louis Ferdinandstrasse, Berlin
1893		Napier, John Watson, Corporation Gas Works, Alloa, N.B.
1909		Napier, Thomas, Arbiene, Clarkston, Busby, Glasgow
1900	Trans.	Napper, Sidney Scrivener, A.C.G.I., A.I.C., c/o Messrs. S. Cortauld and Co., Ltd., Foleshill-road, Coventry
1898		Nash, Leonard Myddelton, F.I.C., 3, Princess-road, Finsbury Park, N.
1900		Naylor, Ernest Brooks, M.Sc. (Vict.), A.I.C., 73, Castle-street, Bolton
1906		Naylor, George, 5, Albert-terrace, Promenade, Blackpool
1891		Naylor, William, 3, Garstang-road, Fulwood-park, Preston
1878	Trans.	Naylor, William Arthur Harrison, F.I.C., 38, Southwark-street, S.E.
1899	Trans.	Neale, Harry Ainley, Mission Junction, British Columbia
1908		Neech, Herbert Richard, 20, Colegrave-street, Lincoln
1898		Neilson, Alexander MacGillivray, Umbilo Post Office, via Durban, Natal, S. Africa
1908	Trans.	Neogi, Punchānan, Prof., M.A. (Calcutta), Rajshahi College, Rajshahi, Eastern Bengal and Assam, India
1901		Neumann, Edgar David Maurice, M.A. (Oxon.), Ph.D. (Göttingen), A.I.C., 7 & 8, Idol-lane, E.C.
1878	Trans.	‖Nevile, Ralph Henry Christopher, Wellingore Hall, Lincoln
1871	Trans.	‖Nevill, Edmund Neville, F.R.S., F.I.C., Government Laboratory, Durban, Natal, S. Africa
1890	Trans.	Neville, Francis Henry, M.A. (Cantab.), F.R.S., Sidney College, Cambridge
1905	Trans.	Neville, Henry Allen Dugdale, B.Sc. (Lond.), F.I.C., County Technical Laboratories, Chelmsford
1892		‖Newall, John Fenton, 33, George-street, Manchester
1885		‖Newbolt, Francis George, M.A. (Oxon.) Balliol College Laboratory, Oxford
1901		Newbould, Herbert Simpson, 15, York-road, Heaton Moor, near Stockport
1864		‖Newlands, Benjamin Edward Reina, F.I.C., 2, St. Dunstan's-hill, E.C.
1891		‖Newlands, William Peter Reina, 10, Cricklade-avenue, Streatham Hill, S.W.

Date of Election.		
1889		Newsholme, George Thomas Wilkinson, 27, High-street, Sheffield
1894	Trans.	Newth, George Samuel, F.I.C., Royal College of Science, South Kensington, S.W.
1895		Newton, Charles Butterworth, Whitehall-chambers, Carlisle
1883		Newton, William, Ph.D. (Zürich), F.I.C., Dyne House, 24, Gordon-street, W.C.
1899	Trans.	Nicholls, William Walter Scott, B.Sc. (Lond.), 230, Brockley-road, Brockley, S.E.
1870	Trans.	‖Nicholson, Edward, Brigade Surgeon, Lieut.-Col., M.R.C.S. (Eng.), L.S.A. (Lond.), D.P.H. (Cantab.), F.I.C., 1, Huskisson-street, Liverpool
1889		Nickels, Wallace Christopher, 41, Cheapside, E.C.
1892		Nickolls, John Bate, The Exchange, Malvern
1883	Trans.	Nicol, William Walker James, M.A. and D.Sc. (Edin.), F.I.C., 15, Blacket-place, Edinburgh
1900		Nightingale, Thomas Marginson, B.Sc. (Vict.), 375, Bridgman-street, Bolton
1898		Nightscales, Thomas Arthur, 37, Jalland-street, Hull
1894		Nixon, Alfred, 7, Oak-road, Sale, Manchester
1869		Noble, Sir Andrew, Bart., K.C.B., D.C.L. (Dun.), F.R.S., Jesmond Dene House, Newcastle-on-Tyne
1908		Norman, Cyril Lawrence, 247A, Cavendish-road, Balham, S.W.
1903	Trans.	Norman, George Marshall, B.Sc. (Lond.), A.R.C.S., A.I.C., 120, Walmersley-road, Bury, Lancs.
1889		Norman, John Thomas, 23, Leadenhall-street, E.C.
1908		Normand, Alexander Robert, M.A. and B.Sc. (Edin.), Wilson College, Bombay, India
1861		Norrington, Frederick, 5, Downfield-road, Clifton, Bristol
1892		Norris, Charles James, 31, Airedale-avenue, Chiswick, W.
1897	Trans.	North, Barker, 22, Park-avenue, Great Horton, Bradford
1892		Northing, John, The Murrough, Wicklow
1854		Norton, Fletcher, Longtown, Abergavenny
1878		‖Norton, Thomas Herbert, Prof., Ph.D. (Heidelberg), D.Sc. (Hamilton), c/o The American Consulate, Theaterstrasse, 14, Chemnitz, Saxony, Germany
1901		Nunn, Arthur William, 57, Crouch-street, Colchester
1907		Nuttall, Walter Harold, F.I.C., Lyndhurst, Aldenham-road, Watford
1904		Oakden, William Edward, 2, Gledhow-terrace, South Kensington, S.W.
1893	Trans.	Oates, William Henry, Broomhall-park, Sheffield
1907		Oberländer, Otto, Ph.D. (Heidelberg), 29, Queen-street, E.C.

Date of Election.			
1903			O'Brien, Frederick, M.Sc. (L'pool.), Lynwood, Bishopsworth, Bristol
1902			O'Connor, Sinnott Valentine, 14, Selskar-street, Wexford
1890			Oddy, Robert Walter, F.I.C., Waterhouse, Toad-lane, Rochdale
1873			‖Odling, Walter, F.I.C., c/o Messrs. Bass and Co., Burton-on-Trent
1848	Trans.	S. 1856-69 V.P. 1869-73 P. 1873-5	Odling, William, Prof., M.A. (Oxon.), M.B. and F.R.C.P. (Lond.), Hon. Ph.D. (Leyden), F.R.S., F.I.C., 15, Norham-gardens, Oxford
1905			‖O'Farrelly, Alfons, M.A. (R.U.I.), 65a, Upper Leeson-street, Dublin
1902			Ogilvie, Allan, Levendale, Frodingham-road, Scunthorpe, Doncaster
1908			‖Oke, Alfred William, B.A. and LL.M. (Cantab.), 32, Denmark-villas, Hove, Sussex
1909			Okell, Frederick Leigh, A.I.C., c/o Straits Trading Co., Ltd., Singapore, Straits Settlements
1908			Okell, Stanley Allen Warrington, 27, King's-road, Ealing, W.
1901			Oldershaw, William, Strelley, Nottingham
1904			Oldfield, Laurel Cecil Francis, 5, Pump-court, Temple, E.C.
1906			Oliver, Edgar Gale, M.A. (Cantab.), Chigwell School, Essex
1889			O'Mahony, Daniel John, Municipal-buildings, Cork
1901			Oram, Frank, Market-place, Romsey
1890	Trans.		Ormandy, William Reginald, Bewsey Cottage, Warrington
1869			‖Orme, Temple A., University College School, Frognal, N.W. and 213, Uxbridge-road, W.
1872			‖Ormerod, Joseph Arderne, M.D. (Oxon.), M.R.C.S. (Eng.), F.R.C.P. (Lond.), The Medical Committee Room, St. Bartholomew's Hospital, E.C.
1887			‖Ormiston, Archibald R., Braeholm, Helensburgh; and 213, St. Vincent-street, Glasgow
1893			Orr, Alexander, Norwich-chambers, 35A, Bligh-street, Sydney, N.S.W.
1881			Orr, John Bryson, Crossacres, Much Woolton, Liverpool
1897	Trans.		‖Orton, Kennedy Joseph Previté, Prof., M.A. (Cantab.), Ph.D. (Heidelberg), F.I.C., Llwyn Eithin, and University College of North Wales, Bangor
1881	Trans.		O'Shea, Lucius Trant, M.Sc. (Sheffield), B.Sc. (Lond.), The University, Sheffield
1887			Ostersetzer, Julius, F.I.C., c/o Messrs. W. and H. M. Goulding, Manure Manufacturers, North Wall, Dublin
1883	Trans.		O'Sullivan, James, F.I.C., High Bank, Burton-on-Trent
1899			O'Sullivan, John, 1649, Barclay-street, Vancouver City, British Columbia

Date of Election.		
1887		||O'Sullivan, Patrick Thomas, M.D. and B.Ch. (R.U.I.), 20, South Mall, Cork
1891		Ough, Lewis, Fernleigh, St. James's-road, Leicester
1888		Overbeck, Otto Christoph Joseph Gerhard Ludwig, Chantry House, Great Grimsby
1887		||Overend, Frederick Lawrence, B.A. (Oxon.), 74, Rowley-street, Walsall
1909		Owen, Robert Cecil, B.Sc. (Lond.), 89, Foregate-street, Chester
1906		Oxland, Charles Harold, B.Sc. (Manc.), The Grammar School, Wellingborough
1909		Painter, Frederick Hubert, B.Sc. (Lond.), 29, Talbot-road, Winton, Bournemouth
1884		||Pallister, John William, B.Sc. (Lond.), 107, Waverley-road, Bradford
1888		Palmer, Henry John, Banff, Alberta, Canada
1899		Palmer, Thomas Henry, c/o Broken Hill Junction North Silver Mining Co., P.O. Box 98, Broken Hill, N.S.W.
1879		Palmer, Sir Walter, Bart., B.Sc. (Lond.), The College, Reading; and 50, Grosvenor-square, W.
1902		Panisset, Sydney Glyde Stephen, Ravenswood, Cherrybinton-road, Cambridge
1899	Trans.	Panting, Laurence Christopher, M.A., M.D. and B.Ch. (Oxon.), 45, Lemon-street, Truro
1900		Pardy, Alexander, Central Experiment Farm, Cedara, Natal, S. Africa
1898		Parker, Alfred James, Shamien, Brighton-road, Purley, S.O., Surrey
1897		Parker, Charles Henry, 106, Tettenhall-road, Wolverhampton
1882		Parker, Joseph Richard, Avondale, 129, Kyverdale-road, Stoke Newington, N.
1894	Trans.	Parker, Matthew Archibald, Prof., B.Sc. (Glas.), University of Manitoba, Winnipeg, Canada
1882		||Parker, Robert Henry, Ravenscar, Orchard-road, Blackheath, S.E.
1901		Parkes, Albert Edward, F.I.C., Chemical Laboratory, 43, Whitehorse-street, Stepney, E.
1890		Parkes, Thomas, M.A. (Cantab.), 2, Gawber-road, Barnsley
1906		||Parkin, John, M.A. (Cantab.), Blaithwaite, Carlisle
1865	Trans.	||Parkinson, James, Queen's-chambers, Pirie-street, Adelaide, S. Australia
1893		||Parrish, Samuel, B.Sc. (Lond.), 80, Grange-avenue, Chapeltown-road, Leeds
1892		Parry, Ernest John, B.Sc. (Lond.), F.I.C., Thanet House, 56A, Great Dover-street, S.E.

Date of Election.			
1903			Parry, William, B.Sc. (Lond.), Incewood, Waterloo-park, Liverpool
1870			Patchett, Isaac, F.I.C., 59, Holyrood-terrace, Carlinghow, Batley
1894	Trans.		Paterson, David, F.R.S.E., Lea Bank, Rosslyn, Midlothian
1885	Trans.		Patterson, George, F.I.C., The Manbré Saccharine Co., Hammersmith, W.
1896			Patterson, Joseph William, 20, South-road, West Hartlepool, Durham
1870	Trans.		Patterson, Thomas Law, F.I.C., Maybank, Finnart-street, Greenock
1904	Trans.		Patterson, Thomas Stewart, D.Sc. (Lond.), Ph.D. (Heidelberg), Chemical Department, The University, Glasgow
1863	Trans.	{ V.P. 1891-4 }	Pattinson, John, F.I.C., 10, Dean-street, Newcastle-on-Tyne
1868	Trans.		‖Paul, Benjamin Horatio, Ph.D. (Giessen), Analytical Laboratory, 13, Fenchurch-street, E.C.; and Parkside, Kingston Vale, Putney, S.W.
1885	Trans.		Paul, Lewis Gordon, Ph.D. (Tübingen), F.I.C., Market Hall-chambers, King-street, Huddersfield
1901			Pay, Walter Herbert, Government Explosives Office, P.O. Box 943, Durban, Natal, S. Africa
1896			Payne, Arthur, c/o Messrs. Mawson and Swan, Moseley-street, Newcastle-on-Tyne
1893			Payne, George Frederick, M.D. (Atlanta), 60, Armstrong-street, Atlanta, Georgia, U.S.A.
1899	Trans.		Peachey, Stanley John, School of Technology, Whitworth-street, Manchester
1901			Peacock, Arthur, B.Sc. (Vict.), The Brebner Schools, Bloemfontein, S. Africa
1900			Pearce, Ernest Vivian, The Hollies, Hayle, Cornwall
1874			Pearce, William, M.P., Chemical Works, Bow Common, E.
1906			Pearse, Leonard Edward Beard, A.R.S.M. (Lond.), 79, Woodfield-road, Ealing, W.
1908			Pearson, George Edward, c/o Messrs. Burroughs, Wellcome & Co., Snow Hill Buildings, E.C.
1908			Pearson, John William, B.A. (Cantab.), 108, Wilderspool-road, Warrington
1894	Trans.		Pearson, William Henry, 6, Fenchurch-buildings, E.C.
1902			Peck, John Wicliffe, 13, Springwell-avenue, Harlesden, N.W.
1894			Peden, John, Chemical Laboratory, 11, Duff-street, Greenock
1870	Trans.	V.P. 1907-	‖Pedler, Sir Alexander, Prof., C.I.E., F.R.S., F.I.C., 28, Stanhope-gardens, Queen's Gate, S.W.
1904			Pell, Alfred, 44, Cumballa-hill, Bombay, India
1886	Proc.		Pendlebury, William Henry, M.A. (Oxon.), Woodford House, Mountfield, Shrewsbury

Date of Election.			
1905			Penn, Francis Richard, A.R.C.S., 8, Landseer-grove, Victoria Park, Bramley, Leeds
1870			Penney, Mulgrave Daniel, 11, High-street, Hull
1895			Pennington, William Henry, Westgate, Longley-road, Worsley
1905			Pennycuick, Thomas, B.Sc. (Lond.), 6, Darley-drive, West Derby, Liverpool
1906			Pennymore, Percy George, Runswick, Dudley-road, Brierley Hill
1886			Pentecost, Stephen James, Alexandra-mount, Mapperley Hill, Nottingham
1884	Trans.	C. 1906-	Perkin, Arthur George, Prof., F.R.S., F.I.C., Grosvenor Lodge, Grosvenor-road, Leeds
1891	Trans.		‖Perkin, Frederick Mollwo, Ph.D. (Würzburg), 199, Piccadilly, W.
1884	Trans.	C. 1891-5 V.P. 1906-9	†Perkin, William Henry, Prof., Ph.D. (Würzburg), F.R.S., F.I.C., Fairview, Wilbraham-road, Fallowfield, Manchester
1906			Perkins, William Hughes, B.Sc. (Manc.), The University, Leeds
1890	Trans.		‖Perman, Edgar Philip, D.Sc. (Lond.), University College, Cardiff
1905			Perrott, Bert, 5, Gnoll-avenue, Neath, Glam.
1908			Perry, Frank, 63, Tunnel-street, Coseley, Bilston
1900			Pettigrew, Robert, 44, Mosley-street, Manchester
1902			Phelps, John, M.A. (Oxon.), The Royal Mint, E.; and Newcroft, Egmont-road, Sutton, Surrey
1881			Philip, Arnold, B.Sc. (Lond.), A.R.S.M., F.I.C., Chemical Laboratory, H.M. Dockyard, Portsmouth
1897	Trans.		Philip, James Charles, M.A. and D.Sc. (Aberd.), Ph.D. (Göttingen), Royal College of Science, South Kensington, S.W.
1887			Phillips, Arthur Gaved, A.R.S.M., F.I.C., 11, Essex-villas, Phillimore-gardens, Kensington, W.
1904			Phillips, George Frederick Tyler, B.Sc. (Lond.), University College, Southampton
1897	Trans.		Phillips, Harry Edward William, M.A. and B.Sc. (Oxon.), Church House, Summertown, Oxford
1882			Phillips, Henry Harcourt, Lynwood, Turton, Lancs.
1902	Trans.		Phillips, Percy Philip, Ph.D. (Göttingen), Thomason Engineering College, Rurki, United Provinces, India
1908			Phillips, Thomas Richard, 5, Enmore-road, Putney, S.W.
1900			Phillpotts, Geoffrey Surtees, B.A. (Cantab.), 108, James'-street, Dublin
1905			Phipson, Percy Barker, c/o Messrs. J. Staples and Co., Ltd., Wellington, New Zealand
1909			Pickard, Joseph Allen, B.Sc. (Lond.), A.R.C.S., Rose Bank, Rose-valley, Brentwood

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† Longstaffe Medallist 1900.

Date of Election.			
1897	Trans.		‖Pickard, Robert Howson, D.Sc. (Lond.), Ph.D. (Munich), B.Sc. (Birm.), F.I.C., Municipal Technical School, Blackburn
1891			Pickering, Michael Samuel, B.Sc. (Lond.), 38, Price-street, Burslem
1878	Trans.	C.1886-7, 89–93, 1901–04.	‖Pickering, Spencer Percival Umfreville, M.A. (Oxon.), F.R.S., F.I.C., Harpenden, Herts.
1906	Trans.		Pickles, Samuel Shrowder, D.Sc. (Vict.), Imperial Institute, S.W.
1890	Trans.		‖Picton, Harold, B.Sc. (Lond.), Clacton College, Clacton-on-Sea
1909	Trans.		Picton, Norman, B.Sc. (Wales), Ph.D. (Leipzig), 4, Pembroke-square, Kensington, W.
1894			Pike, Ernest Brooke, Grasmere, 515, Romford-road, Forest Gate, E.
1903			Pike, Henry George, 8, Eastbourne-avenue, Claremont-road, Bath
1874	Trans.		‖Pike, William Herbert, Prof., Ph.D. (Göttingen), Sandhills, Salcombe, S.O., Devon
1883			‖Pilley, John J., Ph.D., 167, Camberwell-grove, S.E.
1896			Pilley, Thomas William, 33, Grove-hill-road, Denmark Hill, S.E.
1904			Pinchbeck, Gerald, c/o Messrs. Hough, Hoseason & Co., Chemical Works, Holland-street, Pendleton, Manchester
1889			Ping, William, 14, Selsdon-road, Wanstead, N.E.
1908			Pingriff, George Neville, B.A. (Cantab.), 103, Finch-road, Handsworth, Birmingham
1889			Pingstone, George Arthur, P.O. Box 445, Bulawayo, S. Africa
1904			Pinkerton, David John, Dalzell Steel and Iron Works, Motherwell, N.B.
1908			Pinnock, Douglas Robert, A.C.G.I., 166, Darnley-street, Pollokshields, Glasgow
1881			Pisani, Orestes Victoriano, 56, Cavendish-road, Balham, S.W.
1903	Trans.		Pitt, Arthur Ernest, 66, Abbott-road, Bromley, E.
1903			Pitt, Harold Russell, 21, Parkview-terrace, Welling
1882			‖Pitt, Theophilus, c/o Messrs. Burgoyne & Co., High-street-south, East Ham, E.
1899			Pittuck, Frederick Williams, 19, Stratford-grove, Heaton, Newcastle-on-Tyne
1899			Pizey, James Henry, A.R.C.S., F.I.C., Bella Vista 19, Minas de Rio Tinto, Provincia de Huelva, Spain
1893			Platt, Charles, M.D., Ph.D., 3612, Baring-street, Philadelphia, U.S.A.
1899	Trans.		‖Plimmer, Robert Henry Aders, D.Sc. (Lond.), 3, Hall-road, N.W.
1907			Pochin, Harold, B.A. (Cantab.), Selwyn, Cross Oak-road, Berkhamsted
1888			Pollard, Frederick Ernest, F.I.C., 14, Old Hall-street, Hertford

Date of Election.			
1898	Trans.		Pollard, William, M.A. (Cantab.), D.Sc. (Tübingen), The Museum, Jermyn-street, S.W.
1903			‖Pollard, William Branch, B.A. (Cantab.), Laboratory-buildings, Public-works-gardens, Cairo, Egypt
1902			Pollitt, George Paton, B.Sc. (Vict.), Ph.D. (Bâle), Winnington, Northwich, Cheshire
1901			Pollitt, James Charles Tomlin, 7, Grosvenor-road, Handsworth, Birmingham
1896			Pollitt, Robert Barnabas, F.I.C., Dinamita, *via* Noé, Durango, Mexico
1894	Trans.		‖Pollok, James Holms, D.Sc. (Glas.), Royal College of Science, Stephen's-green, Dublin
1903			Pond, George Gilbert, Prof., M.A. and Ph.D. (Amherst), State College, Pennsylvania, U.S.A.
1890			Pond, James Alexander, Auckland, New Zealand
1899			Ponthieu, Georges, 25, St. Jean Baptiste, Montreal, Canada
1848			Pontifex, Edmund Alfred, M.Inst.C.E., 6, Cadogan-court-gardens, Cadogan-place, S.W.
1905			Pooler, Frederick John, B.Sc. (Birm.), P.O. Box 508, Kimberley, S. Africa
1909	Trans.		Pope, Frank George, 28, Alcester-crescent, Upper Clapton, N.E.
1898	Trans.		Pope, Thomas Henry, B.Sc. (Birm.), A.C.G.I., F.I.C., Brewing School, The University, Birmingham
1891	Trans.	C. 1900-2	†‖Pope, William Jackson, Prof., M.A. (Cantab.), M.Sc. (Manc.), F.R.S., F.C.G.I., F.I.C., Chemical Laboratories, The University, and Holmesdale, Brooklands-avenue, Cambridge
1906			Porritt, Benjamin Dawson, B.Sc. (Lond.), A.I.C., c/o Miss Laing, 62, Queen-street, Edinburgh
1903			Porter, Robert James, 11, Arlington-street, Hull
1884	Proc.		‖Porter, Thomas Cunningham, M.A. and D.Sc. (Oxon.), Upton-park, Slough; and Eton College, Windsor
1904			‖Porter, Thomas Linton Daniel, B.Sc. (Lond.), 161, Downsell-road, Stratford New Town, E.
1883			Potter, Charles Edward, c/o Messrs. Tate and Sons, Love-lane Sugar Refinery, Liverpool
1901			Potter, Rowland Samuel, c/o Defender Dry Plate Co., Germantown, Philadelphia, U.S.A.
1896			Potts, Henry William, Hawkesbury Agricultural College, Richmond, N.S.W.
1895			Powell, Harry James, 125, Thurlow-park-road, Dulwich, S.E.
1884			‖Power, Francis Reginald, The Royal Mint, Melbourne, Australia

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† Longstaffe Medallist 1903.

Date of Election.			
1896	Trans.		Power, Frederick Belding, Ph.D. (Strassburg), Hon. LL.D. (Wisconsin), 6, King-street, Snow-hill, E.C.
1908			Power, George O'Brien, Assistant Opium Agent, Fatehpur, U.P. of Agra and Oudh, India
1902			Powney, William Edmund Francis, A.I.C. 17, Nightingale-lane, Hornsey, N.
1904	Trans.		Prentice, Bertram, Ph.D. (Munich), D.Sc. (Edin.), Royal Technical Institute, Salford
1902			Přibram, Richard, Hofrat Prof. Dr., Horlgasse 9, Vienna IX., Austria
1882			‖Price, Arthur Faraday, 2503, Broadway, San Francisco, Cal., U.S.A.
1899			Price, Robert Coleman, Prof., The Miller School, P.O., Albemarle Co., Va., U.S.A.
1901	Trans.		Price, Thomas Slater, D.Sc. (Lond. and Birm.), Ph.D. (Leipzig), F.I.C., Chemical Department, Municipal Technical College, Suffolk-street, Birmingham
1889			‖Priestley, Charles William, B.Sc. (Lond.), A.R.C.S., Richmond Lodge, Torquay
1871	Trans.		‖Procter, Henry Richardson, Prof., Hon. M.Sc. (Leeds), F.I.C., The University, Leeds; and Rowangarth, Ben Rhydding, viâ Leeds
1889	Trans.		Proctor, Charles, F.I.C., 43 D, London-road, Forest Hill, S.E.
1896	Proc.		Proude, James, c/o John Turner, Esq., Providence Soap and Oil Works, Halifax
1897			Pullar, Herbert Spindler, Pullar's Dye Works, Perth, N.B.
1882			‖Pullar, Rufus Daniell, Brahan, Perth, N.B.
1902			Puntan, Herbert Harding Cruikshank, Borough Analyst's Office, London-chambers, Durban, Natal, S. Africa
1875	Trans.	C. 1888-92 V.P. 1899-1902	Purdie, Thomas, Emeritus Prof., Ph.D. (Würzburg), Hon. LL.D. (Aberd.), B.Sc. (Lond.), F.R.S., A.R.S.M., F.I.C., The University, St. Andrews
1901	Trans.		Purvis, John Edward, M.A. (Cantab.), A.R.C.S.I., F.I.C., University Chemical Laboratory, Cambridge
1906			Pye, Thomas Ebenezer, Clovelly, Chichester, Sussex
1886			Pyke, Lazarus Simon Magnus, Assoc.M.Inst.C.E., M.Inst.E.E., 10, Westbourne-terrace, Hyde Park, W.
1905	Trans.		Pyman, Frank Lee, M.Sc. (Vict.), Ph.D. (Bâle), Carlee, Selborne-road, Sidcup, S.O., Kent
1905			Quant, Ernest, 2, Park-crescent, Torquay
1868			Quibell, Oliver, Shalem Lodge, Newark
1894			Quinn, Gerald Grattan, A.R.C.S., 6, Glenroyd, Spotland, Rochdale

Date of Election.			
1901			Radcliffe, Lionel Guy, 6, Alma-terrace, Old Trafford, Manchester
1902			Ralphs, Edwin, Queen's College, Hong Kong
1897			Ralston, William, B.Sc. (Lond.), F.I.C., 3, Windsor-terrace, Linthouse, Govan, Glasgow
1892	Trans.		‖Ramage, Hugh, M.A. (Cantab.), A.R.C.S.I., F.I.C., Ridgemont, Carrow-hill, Norwich
1873	Trans.	C. 1886-9 V.P. 92-5, 1897-1900 F.S. 1902-1907 P. 1907-9	†‖Ramsay, Sir William, K.C.B., Ph.D. (Tübingen), Hon. LL.D. (Glas.), Hon. Sc.D. (Dub. and Cantab.), Hon. D.Sc. (Oxon., L'pool and Columbia), F.R.S., F.I.C., University College, W.C.; and 19, Chester-terrace, Regent's Park, N.W.
1901			Ramsden, William Cecil, 107, Moyne-road, Rathmines, Dublin
1902			Ramshaw, Walter, Oakleigh, Cann-road, Shaftesbury, Dorset
1885			Ranken, Charles, Stockton-road, Sunderland
1889			Ransom, Francis, The Chilterns, Hitchin
1898			Ratcliffe, Walter, 21, Mawdsley-street, Bolton
1905			Ratcliffe, William Henry, B.Sc. (Lond.), 46, Glenhouse-road, Eltham Park, S.E.
1906			Rawles, Walter Hansen, 81, Lewisham High-road, S.E.
1880			‖Rawson, Christopher, F.I.C., Battenberg-avenue, Leicester
1884	Trans.		‖Rawson, Sidney George, D.Sc. (Lond.), F.I.C., Battersea Polytechnic, Battersea, S.W.
1898			Ray, John Armstedt, jun., B.A. (Dub.), 15, Nassau-street, Dublin
1908			Ray, Haradhan, M.A. (Calcutta), 9, Protap Chatterjee's-lane, College-street, Calcutta, India
1902	Trans.		Rây, Prafulla Chandra, Prof., Presidency College, Calcutta
1889	Trans.		‖Read, Arthur Avery, Prof., M.Met. (Sheffield), F.I.C., University College, and 3, Fitzalan-place, Cardiff
1895			Read, Edwin James, B.A. (Cantab.), F.I.C., Portland, Belmont-road, Westgate-on-Sea
1899	Trans.		Read, Harold McLean, 19, Baronsmead-road, Castlenau, Barnes, S.W.
1900			Readman, James Fraser, 8, Park-avenue, Glasgow
1908			Readwin, William, Elmley, Morley, Leeds
1890			Redding, Richard James, 29, Isla-road, Plumstead, Kent
1906			Redgrove, Herbert Stanley, B.Sc. (Lond.), 138, Tottenham-court-road, W.
1892			Redman, Henry Ramsden, 60, Nelson-road, Gillingham, Kent
1866		C. 1891-2	Redwood, Sir Boverton, Hon. D.Sc. (Ohio), F.R.S.E., F.I.C., 4, Bishopsgate-street-within, E.C.
1889			Redwood, Robert, 4, Bishopsgate-street-within, E.C.
1886	Trans.		Rée, Alfred, Ph.D. (Berne), 15, Mauldeth-road, Withington, Manchester
1882	Proc.		Reed, Lester, F.I.C., Hyrsthof, 19, South-park-hill-road, South Croydon

† Longstaff Medallist, 1897.

Date of Election.			
1909			Regan, Colston James, 14, Penerley-road, Catford, S.E.
1880			‖Regester, William, 13, Corfton-road, Ealing, W.
1897			Reid, Alexander Ferguson, Bonshaw, Stewarton, N.B.
1893			Reid, Thomas Anderson, Crosby, Isle of Man.
1881			‖Reid, Walter Francis, F.I.C., Fieldside, Addlestone, Surrey
1907	Trans.		Remfry, Frederic George Percy, B.A. (Cantab.), D.Sc. (Geneva), 19, Summerhill-road, Dartford, Kent
1897			Remington, John Stewart, Aynsome, Grange-over-Sands, Carnforth, Lancs.
1886			Remington, Joseph Price, Prof., 1832, Pine-street, Philadelphia, U.S.A.
1908			Rennie, Alexander, P.O. Box 703, Johannesburg, Transvaal, S. Africa
1879	Trans.		Rennie, Edward Henry, Prof., D.Sc. (Lond.), F.I.C., The University, Adelaide, S. Australia
1898	Proc.		Renwick, Frank Forster, Norland House, Avenue-road, Brentwood, Essex
1909			Resker, Herbert Charles, B.A. (Cantab.), The Sugar Works, Cossipore, India
1902	Trans.		Revis, Cecil, 7, Beverley-road, Barnes, S.W.
1873	Trans.	V.P. 1881-4, 89-92, 97-1900. P. 1901-1903.	Reynolds, James Emerson, Prof., Hon. Sc.D. and Hon. M.D. (Dub.), M.R.C.P. (Ireland), L.R.C.P. and S. (Edin.), F.R.S., Broadwalk Hotel, De Vere-gardens, Kensington, W.
1898	Trans.		Reynolds, William Colebrook, B.Sc. (Lond.), Meersbrook, Essex-road, Dartford, Kent
1908	Trans.		Rhead, Ezra Lobb, F.I.C., Stonycroft, Polygon-avenue, Levenshulme, Manchester
1907			Rhodes, Percy Joseph, Bridge House, Church, Lancs.
1898	Trans.		Rich, Edward Milton, 18, Manor-road, Forest Hill, S.E.
1903			Rich, Stiles William George, c/o Messrs. Thomason Chater, Ltd., Stanley-street, South Brisbane, Queensland
1889			Richards, Duncan Taylor, 57, Osborne-avenue, Westoe-lane, South Shields
1889			‖Richards, Edgar, 60, Ayrault-street, Newport, Rhode Island, U.S.A.
1908			Richards, Francis Edward, B.Sc. (Lond.), A.R.C.S., County Secondary School, Redruth
1905			Richards, Frederick George, 21, Dutton-street, Manchester
1889			‖Richards, Percy Andrew Ellis, F.I.C., Thurn Lodge, Upper Richmond-road, Roehampton, S.W.; and Charing Cross Hospital Medical School, W.C.
1886			Richards, William, B.Sc. (Lond.), 58, Thrale-road, S.W.

Date of Election.			
1885	Trans.		‖Richardson, Arthur, The Central Hindu College, Benares, N.W.P., India
1888	Trans.		‖Richardson, Clifford, A.B. (Harvard), M. Am. Soc. C.E., 30, Church-street, New York City, U.S.A.
1906			‖Richardson, Frederic Ion, B.A. (Cantab.), 149, Highbury-hill, N.
1883			Richardson, Frederic William, F.I.C., County Analyst's Office, Bradford.
1903			Richardson, Harold Ernest, B.A. and B.Sc. (Lond.), 1, Penlee-view-terrace, Penzance, Cornwall
1873			Richardson, Henry, Lyndene, Hale-road, Bowdon, Cheshire
1888			Richardson, Hubert Naylor Bardsley, B.A. (Cantab.), 10, Friar-lane, Leicester
1866			Richardson, Joseph, Pansei View, Arran-avenue, Marsland-road, Sale, Manchester
1906			Richardson, Lawrence George, 14, Ash-grove, Horton, Bradford
1892			Richardson, Reginald Edensor Stanley, 10, Friar-lane, Leicester
1887	Trans.		Richmond, Henry Droop, F.I.C., Mex, Avondale-avenue, Woodside Park, N.
1894			Riddick, David Gibson, Stores Department, G.E.R., Stratford, E.
1882	Trans.		‖Rideal, Samuel, D.Sc. (Lond.), F.I.C., 28, Victoria-street, Westminster, S.W.
1882	Trans.		Ridsdale, Charles Henry, F.I.C., Ravenscroft, Roman-road, Linthorpe, Middlesbrough
1888			Rigby, John Samuel, 26, Bagot-street, Wavertree, Liverpool
1905			Rigby, Thomas, c/o Messrs. Crossley Bros., Ltd., Openshaw, Manchester
1898			Rigg, Gilbert, c/o The New Jersey Zinc Co., Palmerton, Carbon Co., Pa., U.S.A.
1851	Trans.	C. 1878-80	Riley, Edward, F.I.C., 14A, Finsbury-square, E.C.
1904			Riley, Louis John Eczekiel, F.I.C., 8, Newton-road, W.
1900			Riley, Walter Alfred, 207, Earlham-road, Norwich
1893			Rintoul, William, F.I.C., Royal Gunpowder Factory, Waltham Abbey
1907			Rixon, Frederic William, M.Sc. (Vict.), Ph.D. (Giessen), 93, Cromwell-road, Bristol
1908			Roach, William Frothingham, M.D. and M.S. (Montreal), L.A.H. (Dub.), Epe, viâ Lagos, Southern Nigeria, Africa
1902			Roast, Harold James, 43, Rielle-street, Cote St. Paul, Quebec, Canada
1893			Robbins, James Henry, B.Sc. (Lond.), 4, Selborne-road, Ilford, Essex
1897			Roberts, Ernest Henry, 81, Cicada-road, Wandsworth, S.W.

Date of Election.		
1883		‖Roberts, Frederick George Adair, Chemical Works, Carpenter's road, Stratford, E.
1899		Roberts, James, jun., 605, Great Western-road, Hillhead, Glasgow
1876		Roberts, Martin Fenn, Mabshill, Epsom
1889		Roberts, Richard Wightwick, c/o Messrs. Rowe & Pitman, 14 Austin Friars, E.C.
1894		Roberts, Thomas John, Ingleside, Park-road, Huyton, near Liverpool
1894		Robertson, Archibald Blair, Struan, Hatherley-road, Sidcup S.O., Kent
1904		Robertson, Franklin Ernest, Gloster House, Harders-road Peckham, S.E.
1903		Robertson, Frederick Duncan Struan, The Hewan, Bearsden, Glasgow
1903	Trans.	Robertson, Philip Wilfred, M.A. (N.Z.), Chemisches Laboratorium (Saal 1), Liebig-strasse, Leipzig, Germany
1907	Trans.	Robertson, Robert, M.A. and D.Sc. (St. Andrews), F.I.C., Research Department, Royal Arsenal, Woolwich, S.E.; and 29, Charlton-road, Blackheath, S.E.
1901	Trans.	Robertson, William, 21, Worfield-street, Battersea Park, S.W.
1889		Robins, Harry Hollis, c/o Messrs. Southwell and Co., Dockhead, S.E.
1903		Robinson, Archibald Louis, Surgeon, R.N., M.A. and M.B. (Dub.), St. Maur, Palmerston-park, Dublin
1896		Robinson, Henry Fishwick, M.Sc. (Vict.), 2, Richmond-street, Droylsden-road, Newton Heath, Manchester
1882	Trans.	‖Robinson, Henry Haliburton, M.A. (Oxon.), F.I.C., 75, Finborough-road, West Brompton, S.W.
1895		Robinson, Herbert Lewin, The Plating Co., 10, Kirby-street, Hatton-garden, E.C.
1907		Robinson, John, Agricultural College, Aspatria, Cumberland
1906		Robinson, Reginald Ernest, B.A. (Cantab.), The Villas, Stoke-on-Trent
1909	Trans.	Robinson, Robert, M.Sc. (Manc.), Field House, Chesterfield
1904		Rodger, Robert, 54, Rostrevor-road, S.W.
1898		Rofe, Henry John, M.A. (Oxon.), 8, Victoria-street, Westminster, S.W.
1883		Rogers, Arthur William, Tadcaster Tower Brewery Co., Tadcaster
1884		Rogers, Francis Murray, 21, Burma-road, Stoke Newington, N.
1905		Rogers, Harold Rudolf, M.A. (Oxon.), 38, King-street, Newcastle, Staffs.
1909		Rogers, Herbert, Stenning House, Cobwell-road, Retford, Notts.
1903		Rogers, William David, B.Sc. (Lond.), A.R.C.S., F.I.C., 36, Grange-road, Smethwick, B.O., Staffs.

Date of Election.			
1906	Trans.		Rogerson, Harold, M.Sc. (Manc.), 6, King-street, Snow Hill, E.C.
1894			Rolfe, John F., 50, South-street, Greenwich, S.E.
1903			Roose, Fitzroy Owen Jonathan, Assoc.Inst.E.E., c/o Cordolia Light, Power and Traction Co., Ltd., Cordolia, Argentine Republic, S. America
1855	Trans.	C. 1860-4, 1871-3 V.P. 73-5, 1877-80 P. 80-2	Roscoe, Sir Henry Enfield, B.A. (Lond.), D.C.L., (Oxon.), LL.D. (Cantab., Dub., Glas., Montreal, Aberd.), Ph.D. and Hon. M.D. (Heidelberg), Hon. D.Sc. (Vict.), F.R.S., 10, Bramham-gardens, South Kensington, S.W.
1891	Trans.	C. 1897-8.	‖Rose, Thomas Kirke, D.Sc. (Lond.), 6, Royal Mint, E.
1896	Trans.		Rosenheim, Otto, Ph.D. (Würzburg), 68, Belsize-park-gardens, N.W.
1894			Ross, Arthur, F.I.C., 1, Glengall-road, Old Kent-road, S.E.
1905			Ross, Frederick Wilson Montrose, 21, Soho-square, W.
1870			Ross, Lewis Buttle, Driffield, Yorks.
1896			Ross, Raymond St. George, F.I.C., Public Analyst's Office, Burnley
1902			Ross, William Charles, Capt., I.M.S., M.B., Ch.B. and D.P.H. (Edin.), Deputy Sanitary Commissioner, Bankipore, E.I.R., Bengal, India
1891	Proc.		Rossiter, Edmund Charles, F.I.C., 4, Park-road, West Smethwick Birmingham
1892			Rothwell, Charles Frederick Seymour, Beech Croft, Mobberley, Knutsford
1904			Rouillard, Marie Jean Louis Ernest, B.Sc. (Edin.), Malvern, Natal, S. Africa
1899			Roundell, Christopher Foulis, Lieut., B.A. (Oxon.), Guards' Club, Pall Mall, S.W.
1905			Rowley, Henry, M.Inst.E.E., 81, Barrack-street, Perth, Western Australia
1906			Rowsell, Philip Foale, Nutbrook, Exmouth, S. Devon
1900			Roy, Mathura Goolab, 74, Iyah Mudali-street, Chintadrepettah, Madras, India
1899			Royal-Dawson, Henry, c/o Messrs. Peyton and Son, Lister-street, Birmingham; and 6, Wimbourne-road, Edgbaston, Birmingham
1901			Royle, Charles Leonard, c/o Messrs. E. Dyer & Co., Lucknow, India
1905			Royle, Harold Marmion, Store House, Gas Works, Beckton, North Woolwich
1909			Rudolf, Norman Scott, Prof., M.Sc. (Vict. and Liverpool), F.I.C., Indian Institute of Science, Bangalore, India
1872	Trans.		Ruffle, John, F.I.C., Musley, Ware, Herts.
1895			Rugginz, William Augustus, Sundridge, St. Alban's-crescent, Woodford Green, Essex
1889	Trans.	C. 1903-05	Ruhemann, Siegfried, M.A. (Cantab.), Ph.D. (Berlin), Gonville and Caius College, Cambridge

Date of Election.			
1883			Rumble, Charles, F.I.C., 9, Sangora-road, New Wandsworth, S.W.
1908			Runeckles, Arthur Robert, 68, Kyrle-road, New Wandsworth, S.W.
1890			‖Russell, Edward, B.Sc. (Lond.), F.I.C., 18, Woodstock-road, Redland-green, Bristol
1898	Trans.		Russell, Edward John, D.Sc. (Lond.), Lawes Agricultural Trust, Rothamsted Experimental Station, Harpenden, Herts.
1901			Russell, James Bertram, B.Sc. (Lond.), Colyton, Hill-road, Weston-super-Mare
1851	Trans.	C. 1863-7, 1870-2 V.P. 1872-3 S. 1873-5 T. 1875-89 P. 1889-91	‖Russell, William James, Ph.D. (Heidelberg), F.R.S., F.I.C., 34, Upper Hamilton-terrace, St. John's Wood, N.W.
1908			Rutter, Clement Thomas, 8, Norwood-view, Halfacre-road, Hanwell, W.
1896			Rutter, Thomas Francis, B.Sc. (Lond.), Ph.D. (Leipzig), Newcastle-under-Lyme
1894			Ryce, George, B.A. (R.U.I.), Irish Agricultural Offices of the Potash Syndicate, 50, Essex-street, Dublin
1901	Trans.		Ryffel, John Henry, M.A. (Cantab.), B.Sc. (Lond.), F.I.C., 10, Grasmere-road, Muswell Hill, N.
1888			‖Sach, Albert John, Technical College, Goulburn, N.S.W.
1868			Sadler, Sir Samuel Alexander, Col., Cleveland Chemical Works, Middlesbrough
1896			Sage, Charles Edward, F.I.C., c/o W. C. Nickels, Esq., 41, Cheapside, E.C.
1909	Trans.		Sageman, Philip John, Government Laboratory, Clements Inn-passage, Strand, W.C.
1907			Sahni, Ruchi Ram, M.A., Government College, Lahore, India
1879	Trans.		‖Sakurai, Joji, Prof., Science College, Imperial University, Tokio, Japan
1880			Salamon, Alfred Gordon, A.R.S.M., F.I.C., 1, Fenchurch-avenue, E.C.
1908			Salamon, Maurice Salamon, 64, Oxford-gardens, N. Kensington, W.
1906			Salmon, Frederick John, c/o Government Survey Department, Colombo, Ceylon
1876			‖Salomons, Sir David Lionel, Bart., M.A. (Cantab.), Assoc. Inst.C.E., J.P., D.L., Broomhill, Tunbridge Wells; and 49, Grosvenor-street, W.
1863			‖Salt, Henry, M.D. and C.M. (Edin.), Inglewood, Great Malvern
1871			‖Salter, Mortyn John, F.I.C., Bank House, Mickleton, S.O., Glos.

Date of Election.		
1859		‖Salter, Thomas William, 193, Priory-road, West-hill, Hastings
1907	Trans.	Salway, Arthur Henry, B.Sc. (Lond.), Ph.D. (Leipzig), 51, Goodmayes-avenue, Goodmayes, near Ilford, Essex
1902		Sampson, John William, Cleveland Pharmacy, Bath
1882		Samuel, William Cobden, Elmdale, 66, Croxted-road, West Dulwich, S.E.
1909		San U, Maung, Chemical Examiner's Office, Rangoon, Burma
1898	Trans.	Sand, Henry Julius Salomon, Ph.D. (Zürich), D.Sc. (Birm.) University College, Nottingham
1870		‖Sandberg, Christer Peter, Palace-chambers, 9, Bridge-street, Westminster, S.W.
1900	Proc.	Sanders, James McConnell, c/o Direccion General de Aduanas, Mexico
1904		Sanders, Percy Richard, West Cliffe, Seaford, Sussex
1888		Sanderson, John, F.I.C., c/o Messrs. B. S. Cohen, Ltd., 15, Clerkenwell-close, E.C.
1882		Sanford, Percy Gerald, F.I.C., 14, Wellington-road, West Croydon
1890		Saniter, Ernest Henry, Strafford Villa, Moorgate, Rotherham
1891		Sanyal, Abhayacharan, Prof., M.A. (Calcutta), Queen's College, Benares, N.W.P., India
1906		Sanyal, Surendra Prasad, M.A. (Calcutta), The Rajbati, Majhauli Raj P.O., Gorakhpur District, U.P., India
1892		Sarbadhicary, Satya-prasad, 1, College-street, Calcutta
1900		Sargeant, Fred Pilkington, College of Pharmacy, Clarendon-road, Leeds
1907		Saunders, George Joseph, B.E. (Sydney), School of Mines Charters Towers, Queensland, Australia
1886		Saunders, William, Prof., Experimental Farm, Ottawa, Canada
1908		Saunderson, William, B.Sc. (Lond.), Armidale School, Armidale, N.S.W.
1909		‖Sawbridge, Bartle Frere, B.A. (Oxon.), A.I.C., Thelnetham Rectory, Diss
1898		Sayer, Harold Charles, 51, Highfield-road, Dartford
1890		Sayers, William Charles, 63, High-street, Lewisham, S.E.
1885		‖Scammell, Luther Robert, c/o Messrs. F. H. Faulding & Co., 54, King William-street, Adelaide, S. Australia
1877		Scarf, Isaac Sydney, F.I.C., City of London College, White-street, Moorfields, E.C.; and 75, Oxford-road, Canonbury, N.
1897		Scargill, Lionel Walter Kennedy, M.A. (Oxon.), 22, Cambridge-street, Eccleston-square, S.W.
1893	Trans.	Schidrowitz, Philip, Ph.D. (Berne), 57, Chancery-lane, W.C.
1888		‖Schieffelin, William Jay, Ph.B. (Columbia), 840, Southern-boulevard, New York, U.S.A.

Date of Election.			
1907			Schlinger, Charles, B.Sc. (Lond.) Acadia House, 273, Camden-road, N.
1905			Schnurmann, Harry Nestor-, 22, Park-avenue, Willesden Green, N.W.
1907			Schober, William Bush, A.M. and B.Sc. (Annapolis), Ph.D. (Johns Hopkins), Lehigh University, South Bethlehem, Pa., U.S.A.
1892			||Schofield, James Alexander, A.R.S.M., F.I.C., The University, Sydney, N.S.W.
1903			Scholefield, Alfred Henry, B.A. and B.Sc. (Lond.), 57, The Avenue, Leigh, Lancs.
1905	Trans.		Scholefield, Fred., M.Sc. (Vict.), B.Sc. (Lond. and Leeds), A.I.C., c/o Messrs. H. Ashwell & Co., Ltd., New Basford, Nottingham
1902			Scholes, William, Mount Sion, Radcliffe, Lancs.
1899	Trans.		Schryver, Samuel Barnett, D.Sc. (Lond.), Ph.D. (Leipzig), 27, Arundel-gardens, Notting Hill, W.
1909			Schulten, J. H. Charles, Ph.D. (Erlangen), P.O. Box 279, 4, Pollock-street, Calcutta, India
1896			Scotland, Peter Bain, c/o The Arizona Copper Co., Ltd., Metcalf Mines, Clifton, Arizona, U.S.A.
1879	Trans.	C. 1897-9 S. 1899-1904 T. 1904-	||Scott, Alexander, M.A. and Sc.D. (Cantab.), D.Sc. (Edin.), F.R.S., F.I.C., Davy-Faraday Research Laboratory, 20, Albemarle-street, W.; and 13, Neville-court, Abbey-road, N.W.
1908			Scott, Andrew Laidlaw, F.I.C., Royal Gunpowder Factory, Waltham Abbey, Essex
1890			Scott, Ernest George, 2, Talbot-court, Gracechurch-street, E.C.
1901			Scott, George Charlton, c/o Messrs. Burn & Co., Ltd., Raneegunge, Bengal, India
1905			Scott, John Irwin, M.A. (Oxon.), Deacon's School, Peterborough
1906			Scouller, Walter Daly, B.Sc. (Vict.), Chester Corporation Sewage Purification Works, Chester
1883	Proc.		Scudder, Frank, F.I.C., 44, Mosley-street, Manchester
1906			Seaber, Willie Macro, B.Sc. (Lond.), A.I.C., Firdale, Sheen-lane, East Sheen, S.W.
1896			Seabrooke, Herbert Cecil, F.I.C., Black Ash, Grays, Essex
1891			Searl, Albert, Montreux, Victoria-road, Sidcup, S.O., Kent
1890			Seaton, Edward Cox, M.D. and F.R.C.P. (Lond.), M.R.C.S. (Eng.), F.I.C., 93, St. George's-square, S.W.
1905			Seaton, William Dunham, 40, Argyle-road, Ilford, Essex
1908			Seelhorst, William, c/o Eastern Smelting Co., Ltd., Penang, Straits Settlements
1909			Segaller, David, A.R.C.S., 2, Cannon Hill-terrace, Kingston-road, Merton, S.W.

Date of Election.			
1898			Seligman, Richard, Ph.D. (Heidelberg), A.C.G.I., Oakwood, Oxshott-road, Leatherhead
1892	Trans.	C. 1905-09	Sell, William James, M.A. and Sc.D., (Cantab.), F.R.S., F.I.C., University Chemical Laboratory, Pembroke-street, Cambridge
1875			Sellon, John Scudamore, 78, Hatton-garden, E.C.
1906			Sen, Gopal Chandra, M.A. (Calcutta), Bengal Technical Institute, 92, Upper Circular-road, Calcutta, India
1904	Trans.		Sen, Jatindranâth, M.A. (Calcutta), Agricultural Research Institute, Pusa, Bengal, India
1875	Trans.		‖Senier, Alfred, Prof., Hon. D.Sc. (R.U.I.), M.D. (Mich.), Ph.D. (Berlin), F.I.C., University College, and Gurthard, Galway, Ireland
1906			Senior, John, c/o Messrs. Hargreaves, Bros. and Co., Ltd., Starch, Blue and Blacklead Works, Hull
1903	Trans.		Senter, George, Ph.D. (Leipzig), B.Sc. (Lond.), Chemical Laboratory, St. Mary's Hospital Medical School, Paddington, W.
1896			Severn, Walter Dalrymple, A.R.C.S., Public Health Laboratory, Cape Town, S. Africa
1870	Trans.		Seward, Henry, c/o Messrs. J. B. Freeman, Sons, and Co., Wandle Colour Works, Wandsworth, S.W.
1907			Sewell, William George, B.Sc. (Lond.), Bournemouth School, Bournemouth
1874			‖Sexton, Alexander Humboldt, Prof., F.I.C., F.R.S.E., c/o The Librarian, The Technical College, 204, George-street, Glasgow
1895	Trans.		Seyler, Clarence Arthur, B.Sc. (Lond.), F.I.C., The Technical Institute, Nelson-terrace, Swansea
1904			Shacklady, Thomas George, c/o Messrs. Curtiss and Harvey, Ltd., Cliffe-at-Hoo, Rochester
1880			Shadwell, John Emilius Lancelot, F.I.C., Milton House, Bathwick-hill, Bath
1874			Sharman, William, 186, Mare-street, Hackney, N.E.
1885			Sharp, James, Shirley Manor, Wyke, near Bradford
1895			Sharrott, Thomas Chilwell, B.A. (Dub.), A.R.C.S., F.I.C., Bovey Tracey School, Devon
1895	Trans.		‖Shaw, George Elliott, B.Sc. (Lond.), F.I.C., Mungpoo P.O., Sonada, D.H. Railway, Bengal, India
1908			Shaw, William Bayliss, B.A. (Oxon.), Lonsdale House, Walsall
1887			Sheard, John Tomlinson, Birley Carr, Sheffield
1899			Shelbourn, Edward Thomas, F.I.C., 40, Craven-street, Strand, W.C.
1904	Proc.		Shelton, Henry Stanley, B.Sc. (Lond.), Silvermead, Ashford, Middlesex
1897			Shenton, James Porter, 37, Torbay-road, Chorlton-cum-Hardy, near Manchester

Date of Election.		
1907	Trans.	Shepheard, Frederick George, B.Sc. (Lond.), A.R.C.S., A.I.C., 5, University-road, Galway, Ireland
1899	Trans.	Shepheard, William Frederick John, 12, Bridge-street-row, Chester
1906		Shepherd, Arthur Burton, B.Sc. (Vict.), F.I.C., c/o The British Oil and Cake Mills, Ltd., Copenhagen Mill, Limehouse, E.
1874		‖Shepherd, Harcourt Henry Benjamin, F.I.C., Northcote, Mount Pleasant-lane, Upper Clapton, N.E.
1899		Shepherd, John William, B.Sc. (Lond.), 5, Cleveland-avenue, Merton Park, S.W.
1901	Trans.	Sheppard, Samuel Edward, D.Sc. (Lond.), 100, Bromley-road, Catford, S.E.
1901		Shepperson, William, The Pryors, East Heath-road, Hampstead, N.W.
1891	Trans.	‖Shields, John, D.Sc. (Edin.), Ph.D. (Strassburg), F.I.C., 4, Stanley-gardens, Cricklewood, N.W.
1908		Shilstone, Herbert Maxwell, B.Sc. (Tulane), Theater-platz 4, Göttingen, Germany
1896		Shimomura, Kotaro, Prof., Shinkarasumara, Kajinguchi Sagaru, Kyoto, Japan
1894		Shorthouse, Herbert Stephen, 144, Edmund-street, Birmingham
1906		Shrimpton, John Kirby, Redshaw House, Ripon
1904		Shrubsole, Alfred, 18, Forest-drive-west, Leytonstone, N.E.
1886		Shutt, Frank Thomas, M.A. (Toronto), F.I.C., Experimental Farm, Ottawa, Canada
1890		Shuttlewood, Willis Brewin, 78, Whitehall-park, Hornsey-lane, Highgate, N.
1894		Shuttleworth, Edward Buckingham, Prof., 220, Sherborne-street, Toronto, Canada
1904		Siau, Raymond Louis, 15, Merridale-lane, Wolverhampton
1903		Sibley, Samuel Edward, Tottenham, Warren-road, Marrickville, Sydney, N.S.W.
1889		Sibson, Alfred Edward, 19, Carlingford-road, Hampstead, N.W.
1903		Siddle, George, Middleton-one-row, S.O., Co. Durham
1902	Trans.	‖Sidgwick, Nevil Vincent, M.A. (Oxon.), D.Sc. (Tübingen), Lincoln College, Oxford
1900	Trans.	Silberrad, Oswald, Ph.D. (Würzburg), Buckhurst Hill, S.O., Essex
1886		Silvester, Harry, Hon. B.Sc. (Birm.), F.I.C., 78, Holy Head-road, Handsworth, Birmingham
1906		Sime, Allan, Box 19, Port Limon, Costa Rica, S. America
1899	Trans.	Simmonds, Charles, B.Sc. (Lond.), Airdrie, 61, Cottenham-park-road, Cottenham-park, Wimbledon, S.W.
1889		Simmonds, Henry, Engineer's Office, Gas Works; and Elton View House, Bury, Lancs.

Date of Election.		
1887		‖Simmons, Leonard Owen, 45, Wavertree-road, Streatham Hill, S.W.
1905		Simmons, William Herbert, B.Sc. (Lond.), Oakleigh, Stoke Newington Common, N.
1895		Simons, Albert Joseph, c/o M. Simons, Esq., 31, Little Britain, E.C.
1906	Trans.	Simonsen, John Lionel, M.Sc. (Manc.), 152, Barlow-moor-road, West Didsbury, Manchester
1896		Simpson, Aitken Megget, 27, York-grove, Queen's-road, Peckham, S.E.
1902		Simpson, Duncan Ivan Rennard, c/o Bucks Reef Gold Mine, Colleen Bawn Siding, Southern Rhodesia, S. Africa
1897		Simpson, Edward Sydney, B.E. (Sydney), Geological Survey Laboratory, Museum-street, Perth, Western Australia
1886	Proc.	‖Simpson, William Selby, F.I.C., The Gables, Cannon-hill, Southgate, N.
1902	Proc.	Sindall, Robert Walter, 201, Wellmeadow-road, Catford, S.E.
1889		Singer, Ignatius, 3, Parkfield-road, Manningham, Bradford
1908		Singh, Puran, Acting Imperial Forest Chemist, Dehra Dun, U.P., India
1902	Proc.	Sinnatt, Frank Sturdy, Glenside, Church-lane, Moston, Manchester
1896		‖Sircar, Amrita Lal, 51, Sankaritola, Calcutta, India
1902		Skertchly, William Pearson, F.I.C., 11, Billiter-square, E.C.
1888	Trans.	Skinner, Sidney, M.A. (Cantab.), South Western Polytechnic, Manresa-road, Chelsea, S.W.
1899	Trans.	Skirrow, Frederick William, M.Sc. (Vict.), Ph.D. (Leipzig), 17, Curzon-avenue, Victoria-park, Manchester
1892		Skurray, Thomas, United Breweries, Abingdon, Berks.
1879		Slater, Charles, M.A. and M.B. (Cantab.), M.R.C.S. (Eng.), 81, St. Ermin's-mansions, Westminster, S.W.
1880	Trans.	‖Slater, Harold Humboldt, F.I.C., St. Lawrence, Borstal-road, Rochester, Kent
1903	Trans.	Slator, Arthur, Ph.D. (Leipzig), D.Sc. (Birm.), B.Sc. (Lond.), F.I.C., The Priory, Burton-on-Trent
1878		‖Slatter, George William, A.R.C.S.I., F.I.C., 241, Carlton-terrace, Nab Wood, Shipley, Yorks.
1895		Slocum, Frank Leroy, 401, South Linden-avenue, E.E. Pittsburg, Pa., U.S.A.
1875		‖Smetham, Alfred, F.I.C., Analytical Laboratory, Cereal Chambers, 16, Brunswick-street, Liverpool
1898	Trans.	Smiles, Samuel, D.Sc. (Lond.), University College, Gower-street, W.C.
1883		Smith, Adolphe, 12, Crookham-road, Fulham, S.W.
1890	Trans.	‖Smith, Alexander, Prof., Ph.D. (Munich), B.Sc. (Edin.), University of Chicago, Chicago, Ill., U.S.A.

Date of Election.		
1901		Smith, Andrew Biggam, c/o M. Armstrong, Esq., P.O. Box 90, Queenstown, Cape Colony, S. Africa
1888		Smith, Angus, F.I.C., 10, Ardgowan-street, W., Greenock, N.B.
1898		Smith, Benjamin Jordan, 11, Grosvenor-road, Handsworth, Birmingham
1906		Smith, Charles, Knowsley-road, Smithills, Bolton
1903		Smith, Charles Joseph, Sunnydale, Walton New-road, Stockton Heath, near Warrington
1904	Trans.	Smith, Clarence, D.Sc. (Lond.), Aldersyde, Harpenden-road, Wanstead Park, E.
1894	Trans.	Smith, Claude, F.I.C., Barngarth, Cartmel, Carnforth
1884		‖Smith, Edgar Francis, Trelawny, 21, Fairfax-road, Bedford Park, W.
1906		Smith, Frank, B.Sc. (Vict.), 51, Hilden-street, Haulgh, Bolton
1906		Smith, Fred., Cliff House, Bruntcliffe, Leeds
1874		Smith, George, F.I.C., Nobel's Explosives Co., Polmont Station, N.B.
1896		Smith, George Egerton Scott-, F.I.C., 67, Surrey-street, Sheffield
1892		‖Smith, George Percy Darnell-, B.Sc. (Lond.), F.I.C., Chief Secretary's Department, Bureau of Microbiology, Sydney N.S.W.
1890		Smith, Harry Wood, B.Sc. (Vict.), c/o Messrs. John Batt and Co., Ltd., 39, Old Broad-street, E.C.
1896	Trans.	Smith, Henry George, The Technological Museum, Sydney, N.S.W.
1904		Smith, Henry Heron, F.I.C., 76, Plumstead-common-road, Plumstead, Kent
1909	Trans.	Smith, Henry Llewellyn, B.Sc. (Manc.), A.I.C., King's College, Strand, W.C.
1878		Smith, Henry Russell, F.I.C., 1, Aubert-park, Highbury, N.
1900		‖Smith, Herbert Procter, c/o Hawarden Bridge Steel Works, Shotton, Flints.
1901		Smith, James, 80, Ampthill-road, Aigburth, Liverpool
1903		Smith, James Cruickshank, B.Sc. (Aberd.), Holmdene, Colebrook-avenue, West Ealing, W.
1879		Smith, John William, 7, Brookfield-street, Roslindale, Boston, Mass., U.S.A.
1902		Smith, Leonard, Hillside, Park-hill-road, Croydon
1901	Trans.	Smith, Norman, D.Sc. (Vict.), The University, Manchester
1902		Smith, Robert Ely Blake, B.Sc. (Lond.), A.I.C., 31, St. John's-road, Putney, S.W.
1897		Smith, Robert Francis Wood, 90, Lower Thames-street, E.C.
1891		Smith, Robert Greig-, D.Sc. (Edin.), M.Sc. (Dun.), Linnean Society's House, Elizabeth Bay, Sydney, N.S.W.
1907		Smith, Robert Harry, Apsley House, Priory-road, Sheffield
1907		Smith, Robert Low, 56, Genesta-road, Plumstead, S.E.

Date of Election.			
1888			Smith, Samuel, Hillsboro', Goddard-avenue, Old Swindon
1907			‖Smith, Sydney William, B.Sc. (Lond.), A.R.S.M., The Royal Mint, E.
1866	Trans.		Smith, Watson, F.I.C., 34, Upper-park-road, Haverstock Hill, N.W.
1876			‖Smith, William Alexander, M.A. and M.B. (Oxon.), M.R.C.S. (Eng.), 14, Durdham-park, Bristol
1903			Smith, William Veysey, B.A. (Oxon.), 38, St. Petersburgh-place, W.
1883	Trans.	C. 1896-1900. V.P. 1905-08	‖Smithells, Arthur, Prof., B.Sc. (Lond.), F.R.S., F.I.C., The University, Leeds
1873			‖Smyth, John, M.A. (Dub.), M.Inst.C.E., Milltown, Banbridge, Ireland
1908	Trans.		Smythe, John Armstrong, D.Sc. (Dun.), Ph.D. (Göttingen), 15, The Poplars, Gosforth, Newcastle-on-Tyne
1902			Smythe, John Seabury, B.Sc. (Vict.), Ph.D. (Würzburg), Rantallard, Lance-lane, Wavertree, Liverpool
1887	Trans.		‖Snape, Henry Lloyd, Prof., D.Sc. (Lond.), Ph.D. (Göttingen), F.I.C., Balholm, Lathom-road, Southport
1899	Trans.		Soddy, Frederick, M.A. (Oxon.), Chemical Department, The University, Glasgow
1887			Sohn, Charles Emile, F.I.C., 52, Fore-street, E.C.
1891			Solomon, Frank Oakley, Dauntsey's Agricultural School, West Lavington, Devizes, Wilts.
1908			Sommerfeldt, Ernst, Ph.D. (Göttingen), P.O. Box 279, 4, Pollock-street, Calcutta, India
1906			Sommerville, David, B.A. (R.U.I.), M.D., B.Ch., and D.P.H. (Cantab.), M.R.C.P. (Lond.), 31, Manor House, Marylebone-road, N.W.
1893			Sorrell, Henry Thomas, The Eagle Brewery, Wellclose-square, E.
1875			Southall, Alfred, Garrick House, Richmond Hill, Edgbaston
1908			Southcombe, James Edward, M.Sc. (L'pool), 138, Chester-street, Birkenhead
1897	Proc.		Southerden, Frank, B.Sc. (Lond.), F.I.C., Royal Albert Memorial College, Exeter
1897			Southern, Thomas, jun., Wheat Hill Chemical Works, near Broughton Bridge, Manchester
1883			Soward, Alfred Walter, 28, Therapia-road, Honor Oak, S.E.
1892			Spackman, Charles, Rosehaugh, Clitheroe, Lancs.
1908			Speed, John Day, Elmdene, Freezywater, Waltham Cross
1905			Speight, William Ewart, Corporation Sewage Works, Deighton, Huddersfield
1883			‖Spencer, Ernest Samuel, 27, Charlton-road, Blackheath, S.E.

Date of Election.		
1906	Trans.	Spencer, James Frederick, D.Sc. (L'pool), B.Sc. (Vict.), Ph.D. (Breslau), Bedford College for Women, Baker-street, W.
1886		Spencer, Richard, 242, Dalton-road, Barrow-in-Furness
1887		‖Spencer, Walter Shelley, Lyndene, Darley-grove, Farnworth, near Bolton
1894		Spenzer, John George, Prof., M.D., Ph.D. (Strassburg), Ohio Wesleyan University, 1825, East 93rd street, N.E., Cleveland, Ohio, U.S.A.
1904		Spielmann, Percy Edwin, B.Sc. (Lond.), Ph.D. (Bâle), A.R.C.S., F.I.C., 21, Cadogan-gardens, S.W.
1908		Spiers, Charles Sedgley, Beaudesert, Queensland, Australia
1859	Trans.	‖Spiller, John, F.I.C., 2, St. Mary's-road, Canonbury, N.
1863		‖Spiller, William, F.I.C., 2, Lindfield-gardens, Hampstead, N.W.
1885		‖Spottiswoode, William Hugh, Balliol College, Oxford; and 6, Middle New-street, E.C.
1906	Trans.	Sproxton, Foster, B.Sc. (Lond.), Brantham Works, near Manningtree, Essex
1882		‖Squire, Peter Wyatt, 413, Oxford-street, W.
1892		Squires, Alfred James, Greenbank, Coroner's-lane, Farnworth, Widnes, Lancs.
1877		Stacey, Henry George, Brunton's Wharf, 671, Commercial-road, E.
1899		Stainer, John Ward, 103, Cheriton-road, Folkestone
1879	Trans.	‖Stallard, George, M.A. (Oxon.), Horton-crescent, Rugby
1904		Stanger, Reginald Harry Hursthouse, Chemical Laboratory and Testing Works, 2, Broadway, Westminster, S.W.
1902		Stanger, William Charles South, Ambleside, Corder-road, Ipswich
1887		‖Stansell, Lionel William, F.I.C., 7, Albion-place, Maidstone, Kent
1895		‖Stansfield, Alfred, D.Sc. (Lond.), McGill University, Montreal, Canada
1902		Stansfield, Edgar, M.Sc. (Vict.), Macdonald Chemistry and Mining Building, McGill University, Montreal, Canada
1899		Stansfield, Samuel, B.Sc. (Vict.), 2, Park-road, Batley, Yorks.
1900	Trans.	Stapleton, Henry Ernest, Prof., B.A. and B.Sc. (Oxon.), Presidency College, Calcutta, India
1870		Starey, Arthur John, 39, Woodland-gardens, Highgate, N.
1870	Trans.	‖Stark, James Fleming, Rosedale, Bromborough, Cheshire
1906		Starling, William Robert Rigg, 23, Magdalen-road, Norwich
1908		Stead, Arthur, B.Sc. (Vict.), 40, Victoria-road, Bloemfontein, Orange River Colony, S. Africa
1902		Stead, Francis Bernard, 80, St. Mary's-mansions, Paddington, W.
1896		Stead, John Christopher, 55, Chancery-lane, W.C.
1882	Trans.	Stead, John Edward, F.R.S., F.I.C., 11, Queen's-terrace, Middlesbrough

Date of Election.		
1897		Steel, Frederick William, c/o General Chemical Co., Ltd., Clyde, Sydney, N.S.W.
1885		‖Steel, Robert Elliot, Cameron House, Sherborne, Dorset
1900	Trans.	Steele, Bertram Dillon, D.Sc. (Melbourne), The University, Melbourne, Australia
1905		Steger, James, B.Sc. (Lond.), 111, Chesterfield-road, Bristol
1898		Steinhart, Oscar Julian, Ph.D. (Erlangen), 2 and 3, West-street, Finsbury Circus, E.C.
1901		Stell, Samuel Fenton, 25, Henry-street, Keighley
1892	Trans.	‖Stenhouse, James, View-park-gardens, Bonnyrigg, Midlothian
1884		Stenhouse, Thomas, F.I.C., 166, Drake-street, Rochdale
1895	Trans.	Stephens, Frank Robert, c/o Messrs. Idris, Pratt-street, Camden Town, N.W.
1880		‖Stephens, Henry Charles, Avenue House, Finchley, N.
1897		Stephens, Michael Edmund, 57, Aldersgate-street, E.C.
1895		Stephenson, Herbert Frederick, A.R.C.S., F.I.C., 7, Winifred-road, Merton Park, S.W.
1901		Stephenson, Robert, jun., M.A. (Cantab.), Burwell, Cambridge
1891	Trans.	Stephenson, Thomas, 137, George-street, Edinburgh
1888	Trans.	Stern, Arthur Landauer, D.Sc. (Lond.), F.I.C., 148, High-street, Burton-on-Trent
1896		Steuart, Douglas Stuart Spens, B.Sc. (Vict.), The Royal Societies' Club, St. James's-street, S.W.
1903	Trans.	Steven, Alec Bowring, B.Sc. (Lond.), Technical College, Glasgow
1905		Stevens, Edmund Henry, B.A. (Lond.), Haw House, Rothbury, Northumberland
1905		Stevens, Harold Blythen, Oxford Works, Tower Bridge-road, S.E.
1897	Trans.	Stevens, Henry Potter, M.A. (Oxon.), Ph.D. (Heidelberg), F.I.C., 15, Borough, London Bridge, S.E.
1903		Stevens, Montague White, A.R.C.S., A.I.C., H.M. Patent Office, 25, Southampton-buildings, W.C.
1899		Stevenson, Arnold, B.A. (Cantab.), 4, Porchester-gardens, W.
1903	Trans.	Stevenson, Henry Edward, 218, Amhurst-road, Hackney Downs, N.E.
1904		Stevenson, Henry Ernest, Avondale, Ditton Hill, Surrey
1909		Stevenson, James Thomas, 67, Surrey-street, Sheffield
1879		Stevenson, William, 95A, Southwark-street, S.E.
1908		Stewart, Alexander Mackintosh, Penang, Straits Settlements
1903	Trans.	Stewart, Alfred Walter, D.Sc. (Glas.), 53, Shaftesbury-road Ravenscourt Park, W.; and 18, Annfield-terrace, Partickhill, Glasgow
1902		Stewart, Hector, Gulf Creek Copper Mine, via Barraba, N.S.W.

Date of Election.		
1907		Stobie, Harold Ramsay, 4064, Washington-boulevard, St. Louis, Mo., U.S.A.
1866		Stock, William Frederick Keating, F.I.C., 5, Dixon-terrace, Darlington
1887		Stocks, Herbert Birtwhistle, F.I.C., 12, Victoria-road, West Kirby, Cheshire
1894	Trans.	Stoddart, Frederick Wallis, F.I.C., Grafton Lodge, Sneyd-park, Bristol
1879	Proc.	‖Stokes, Alfred Walter, F.I.C., Town Hall, Paddington Green, W.
1908		Stokes, Edward, B.A. (Oxon. and Adelaide), District School, Bareilly, U.P., India
1873		‖Stone, Edward Daniel, Ackersley, Cheadle Hulme, near Stockport, Cheshire
1895		Stone, George, Esk Brewery, Launceston, Tasmania
1875		‖Stone, John Frederic Matthias Harris, M.A. (Cantab.), Barrister-at-Law of the Western Circuit, 3, Dr. Johnson's-buildings, Temple, E.C. ; and Oxford and Cambridge Club, 17, Pall Mall, S.W.
1879		‖Stone, William, M.A. (Cantab.), Oxford and Cambridge, Garrick, Bath, Union, Royal Societies, Automobile, and Reform Clubs ; and 63, Curzon-street, Mayfair, W.
1906		Storey, Francis Wylie, B.Sc. (Lond.), Government School, Bethlehem, Orange River Colony, S. Africa
1900		Storr, Bertram Vincent, M.Sc. (Vict.), 147, Coventry-road, Ilford, Essex
1887		‖Strangman, James Pim, Clydesdale-mansions, 9, Clydesdale-road, Notting Hill, W.
1904	Trans.	Streatfeild, Frederick Henry, 9, Crescent-road, South Tottenham, N.
1906		Streimer, Emanuel George, 4, Clova-road, Forest Gate, E.
1909		Strohmenger, Arthur Percy, Caxton House, Westminster, S.W.
1900		Strong, Archie Hugh, 63, Herne-hill-road, Camberwell, S.E.
1904	Trans.	‖Struthers, Robert de Jersey Fleming-, M.A. and B.Sc. (Oxon.), Exeter College, Oxford
1885	Trans.	‖Stuart, Charles Maddock, M.A. (Cantab.), F.I.C., St. Dunstan's College, Catford, S.E.
1905		Stuart-Shepherd, Charles Stuart, Rev., Church House, Worcester
1897	Trans.	Stubbs, George, Beresford House, Beresford-road, East Finchley, N.
1907		Sturrock, George Colleymore, Capt. R.A., Indian Cordite Factory, Aruvankad, Nilgiris, India
1890	Trans.	‖Sudborough, John Joseph, Prof., D.Sc. (Lond.), Ph.D. (Heidelberg), F.I.C., University College of Wales, Aberystwyth
1878	Trans.	‖Suguira, Shigetake, c/o Tokyo Chemical Society, Science College, Imperial University, Tokyo, Japan

Date of Election.		
1897		Sumner, Leonard, B.Sc. (Vict.), Butt Hill, Prestwich, near Manchester
1907		Sutcliffe, Samuel Mortimer, 4, Clive-place, Bradford
1904		Sutcliffe, Thomas, The Grammar School, Elland, Yorks.
1887		||Sutherland, David Alexander, F.I.C., 26, Victoria-street, Westminster, S.W.
1860		Sutton, Francis, F.I.C., Laboratory, Bank Plain, Norwich
1886		||Sutton, Francis Napier, F.I.C., 6, Grosvenor-gardens, Cricklewood, N.W.
1902		Swain, James, 17, Winsham-grove, Clapham Common, S.W.
1875		Swan, Sir Joseph Wilson, Hon. M.A. and Hon. D.Sc., (Dun.), F.R.S., F.I.C., Overhill, Warlingham, Whyteleaf, S.O., Surrey
1894		||Swinburne, James, F.R.S., 82, Victoria-street, S.W.
1891		Sykes, Matthew Carrington, M.D. (Dun.), F.R.C.S. (Edin.), M.R.C.S. (Eng.), L.R.C.P. and D.P.H. (Lond.), Sykeshurst, Barnsley, Yorks.
1880		Symons, Brenton, M.Inst.C.E., Burwood, Warminster-road, South Norwood, S.E.
1874	Trans.	||Symons, William Henry, M.D. (Brussels), D.P.H. (Oxon.), M.R.C.S. (Eng.), F.I.C., Health Office, Guildhall, Bath
1899	Trans.	Szarvasy, Charles Emerique, Prof., Ph.D. (Buda Pesth), Müegyetem I Ker., Budapest, Hungary
1881	Trans.	||Takamatsu, Toyokichi, Prof., Engineering College, Imperial University, Tokyo, Japan
1887	Trans.	||Takamine, Jokichi, 550, West 173rd-street, New York City, U.S.A.
1906		Talbot, George Stanley, c/o Pacific Phosphates Co., 60A, Pitt-street, Sydney, N.S.W.
1901		Tankard, Arnold Rowsby, F.I.C., 40, Lowgate, and 12, Ferens-avenue, Cottingham-road, Hull
1901		Tatam, George William Gerald, 38, Clark-street, Chattanooga, Tenn., U.S.A.
1909		Tate, Arthur Edwin, M.Sc. (Dun.), Gladstone House, Salter-row, Pontefract
1908		Tate, Francis George Henry, Kilmersdon, Homecroft-road, Sydenham, S.E.
1890		Tate, Francis Henry, 9, Hackins Hey, Liverpool
1881	Trans.	Tate, George, Ph.D. (Würzburg), F.I.C., Windsor Buildings, George-street, Liverpool
1884		||Tate, Walter, Woodlands, Twerton-on-Avon, Bath
1890		Tate, William, Prof., Civil Engineering College, Sibpur, near Calcutta, India

Date of Election.		
1867		Tatlock, Robert Rattray, F.I.C., 11, Bellshaugh-road, Kelvinside West, Glasgow
1882		Taylor, Gotfred Midgley, Caxton House, Westminster, S.W.
1894		Taylor, Herbert John, 52, Alexandra-crescent, Dewsbury
1880		||Taylor, James, B.Sc. (Manc.), A.R.S.M., Adderton, Dundas, N.S.W.
1891		Taylor, John, 15, Lucius-street, Torquay
1888		Taylor, John George, 3, Outram-street, Stockton-on-Tees
1905		Taylor, John William, University College, Reading
1874	Trans.	||Taylor, Robert Llewellyn, F.I.C., 4, St. Werburgh's-road, Chorlton-cum-Hardy, Manchester
1901		Taylor, William Henry, B.Sc. (Lond.), F.I.C., 36, Glenhouse-road, Eltham Park, Kent
1878		||Tcherniac, Joseph, Ph.D. (Zürich), c/o South Metropolitan Gas Co., 709, Old Kent-road, S.E.
1907		Tebb, William Scott, M.A., M.D. and D.P.H. (Cantab.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), L.S.A., F.I.C., Sandfield, Putney Heath-lane, S.W.
1879	Trans.	||Teed, Frank Litherland, D.Sc. (Lond.), F.I.C., 9, Mincing-lane, E.C.
1906		Telling, Harry George, Cooksbridge Brewery, Cooksbridge, Sussex
1906		Tempany, Harold Augustine, B.Sc. (Lond.), F.I.C., St. Johns, Antigua, British West Indies
1907		Templeton, William Sandilands, Prof., M.A. and B.Sc. (Glas.), Medical and Technical College, Colombo, Ceylon
1894		||Terry, Edwin, 374, Brixton-road, S.W.
1881		Tervet, Robert, 68, Windsor-road, Leyton, Essex
1893		Thackrah, James Robert, M.A. (Oxon.), Ph.D. (Leipzig), Technical Schools, Tavistock-road, Plymouth
1895		Theodosius, Alfred Fletcher, M.A. (Oxon.), University College, Oxford
1904		Thibault, Paul John, Somerset, Union-street, Tighe's-hill, Newcastle, N.S.W.
1899		Thiersch, Harry Alexander, c/o British Resin Works, Ltd., Belvedere, S.O., Kent
1901		Thomas, Albert Edward, B.Sc. (Lond.), F.I.C., Boys' Middle School, Castle-street, Tiverton, Devon
1908		Thomas, Frank Moreton, 261, Rotton-park-road, Edgbaston, Birmingham
1907	Trans.	||Thomas, Frederick, M.Sc. (Manc.), 29, Fairhaven-road, St. Anne's-on-the-Sea, Lancs.; and Chemical Department, The University, Manchester
1905		Thomas, George Devenish, B.Sc. (Lond.), 18, Randolph-gardens, Dover

Date of Election.			
1875	Trans.		‖Thomas, Joseph William, F.I.C., Overdale, 6, Kingswood-road, Shortlands, Kent
1909			Thomas, Oswald John Dalgatty, 65, Clarendon-gardens, Ilford, Essex
1907	Trans.		Thomas, Richard Noel Garrod, B.A. (Oxon.), 25, Clytha-park, Newport, Mon.
1877			‖Thompson, Beeby, 67, Victoria-road, Northampton
1904			Thompson, Charles Herbert, Harrington House, Amblecote, Stourbridge
1886	Trans.		‖Thompson, Claude Metford, Prof., M.A. (Cantab.), D.Sc. (Lond.), University College, and 38, Park-place, Cardiff
1894			Thompson, Edward Cumming, Froyle House, Westcombe Park-road, S.E.
1893			Thompson, Frank Ernest, A.R.C.S., F.I.C., 23, Lichfield-street, Walsall
1893			Thompson, George Rudd, F.I.C., The Laboratory, 69, Dock-street, Newport, Mon.
1897			Thompson, Harry, Chemical Laboratory, 5, Bishop-lane, Hull
1904			Thompson, Hubert, B.Sc. (Vict.), Agricultural College, Holmes Chapel, Cheshire
1886			Thompson, William Phillips, 95, Shrewsbury-road, Claughton, Birkenhead
1903			Thomson, George Malcolm, Newington, Dunedin, New Zealand
1872	Trans	C. 1880-3, 1904-06 S. 1883-98 V.P. 1898-1901	‖Thomson, John Millar, Prof., Hon. LL.D. (Glas.), F.R.S., F.I.C., King's College, Strand, W.C.; and 9, Campden Hill-gardens, W.
1899			Thomson, Robert Tatlock, F.I.C., 156, Bath-street, Glasgow
1872			Thomson, William, F.I.C., Royal Institution Laboratory, Manchester
1895			Thomson, William Thomas, Oxford-villas, Waltham Abbey
1906			Thorne, Emanuel Isaac, 55, Nithdale-road, Plumstead, S.E.
1882	Trans.		Thorne, Leonard Temple, Ph.D. (Würzburg), F.I.C., 2, Denbigh-gardens, Richmond, Surrey
1906			Thornton, Percy Charles, Council School, Arnot-street, Walton, Liverpool
1906			Thorp, Arthur William, 210, Sherborne-road, Yeovil
1891			Thorp, Walter, B.Sc. (Lond.), F.I.C., Sorrentoville, Dalkey, Co. Dublin
1871	Trans.	C. 1879-83 V.P. 1884-7 T. 1889-99 P. 1899-1901	†‖Thorpe, Sir Edward, Prof., C.B., D.Sc. (Vict.), Sc.D. (Dub.), Ph.D. (Heidelberg), LL.D. (Glas.), F.R.S., Imperial College of Science and Technology, South Kensington, S.W.
1893	Trans.		Thorpe, Jocelyn Field, D.Sc. (Manc.), Ph.D. (Heidelberg), F.R.S., The University, Manchester: and Yannaford, Heaton Mersey, Lancs.

† Longstaff Medallist, 1881.

Date of Election.			
1899	Trans.		Threlfall, Richard, Prof., M.A. (Cantab.), Assoc. M. Inst. C.E., F.R.S., Oakhurst, Church-road, Edgbaston, Birmingham
1897	Trans.		‖Tickle, Thomas, B.Sc. (Lond.), F.I.C., 83, Queen-street, Exeter
1902			Tidy, Henry Letheby, M.A., M.B., and B.Ch. (Oxon.), M.R.C.S. (Eng.), M.R.C.P. (Lond.), 103, Clarence-gate-gardens, Regent's Park, N.W.
1903			Tilburn, Charles, c/o The Australian Explosives and Chemical Co., Ltd., Deer Park, Victoria, Australia
1865	Trans.	C. 1878-81 V.P. 85-8 91-94, 96-9 T. 1899-03 P. 1903-05	‖Tilden, William Augustus, Emeritus Prof., D.Sc. (Lond.), Hon. Sc.D. (Dub.), Hon. D.Sc. (Vict.), F.R.S., F.I.C., The Oaks, Northwood, S.O., Middlesex
1900			Tilley, James Walter, 95a, Southwark-street, S.E.
1909			Tilley, Vernon James, A.I.C., Linthorpe, Becmead-avenue, Streatham, S.W.
1905			Tillott, John Booty, 37, Marsham-street, Westminster, S.W.
1907			Timpany, Harold Munkman, M.Sc. (Vict.), St. Winifrede's-gardens, Shrewsbury
1904	Trans.		Tingle, Alfred, B.Sc. (Lond.), Ph.D. (Penn.), c/o No. 5 Post Office, Ho Pei, Tientsin City, North China
1889	Trans.		‖Tingle, John Bishop, Prof., Ph.D. (Munich), McMaster University, Toronto, Canada
1907	Trans.		Tinkler, Charles Kenneth, B.Sc. (Wales), The University, Edmund-street, Birmingham
1898			Tisdale, Charles William Walker, The Dairy, Northallerton, Yorks.
1905	Trans.		Titherley, Arthur Walsh, D.Sc. (Vict. and L'pool.), Ph.D. (Heidelberg), Southcot, Manor-hill, Upton, near Birkenhead
1907			Toch, Maximilian, 52, Ninth-street, Long Island City, N.Y., U.S.A.
1891			Tocher, James Fowler, B.Sc. (Aberd.), F.I.C., 5, Chapel-street, Peterhead
1884	Trans.		‖Tompson, Frederick William, The Bower, Limpsfield, S.O., Surrey
1877			‖Toms, Frederick Woodland, F.I.C., Official Analyst, Jersey
1904			Tong, Walter, Holmdene, Pole-lane, Failsworth, Manchester
1904			Tonkin, Arnold Bertram, Government Laboratory, Durban, Natal, S. Africa
1906			Tonkin, Ronald William, 37, Oak-hill-road, Putney, S.W.
1907			Tonner, William Griffiths, B.Sc. (Wales), Dan-y-Bryn, Penywern-road, Neath, Glam.
1893			‖Towers, John William, Victoria-road, Widnes
1903			Toyne, Francis Digby, M.A. (Cantab.), 51, Deeplish-road, Rochdale

Date of Election.		
1901		Tozer, Herbert Ackerman, B.A. (Lond.), 19, Divinity-road, Oxford
1887		‖Traphagen, Frank W., Prof., Ph.D. (New York), Colorado School of Mines, Golden, Colorado, U.S.A.
1900		Traquair, John, Glenfield Starch Works, Paisley, N.B.
1892	Trans.	Travers, Morris William, Prof., D.Sc. (Lond.), F.R.S., Indian Institute of Science, Bangalore, India; and c/o Messrs. Jeremiah Lyon and Co., 4, Lombard-court, E.C.
1906		Treble, Richard Lumley, B.Sc. (Dun.), Culham College, Culham, Oxon.
1908		Trechmann, Adolph Octavius, The Old Palace, Rochester, Kent
1895		Trehärne, Frederick Gwilym, Wrangbrook, Llanishen, near Cardiff
1888		‖Trewby, Herbert, 62, St. John-street, E.C.
1881		‖Trigger, Oliver, F.I.C., Chemical Dept., Royal Arsenal, Woolwich, S.E.
1902		Trimen, Stephen Herbert, Survey Dept., Finance Ministry, Giza, Egypt
1897		Tripp, Edward Howard, Ph.D. (Marburg), The Modern School, Bedford
1905		Troye, Gustave Arthur, P.O. Box 2706, Johannesburg, S. Africa
1909		Truelove, Charles William, B.Sc. (Lond.), 17, Tylney-road, Forest Gate, E.
1905	Trans.	Tuck, William Bradshaw, B.Sc. (Lond.), University College, Gower-street, W.C.
1898	Trans.	Tucker, Samuel Auchmuty, Ph.B. (Columbia), Columbia University, New York, U.S.A.
1889		Tucker, Willis Gaylord, M.D. (Albany), Ph.D. (Union Univ.), Medical College, Albany, New York, U.S.A.
1896		Tuckett, James Edwin Shum, M.A. (Cantab.), Marlborough College, Marlborough
1892		Tuer, Arthur Holt, Thornhill, Wigan, Lancs.
1902		Tunnicliffe, William Wright, B.Sc. (Lond.), Sunnyside, Newhall, Burton-on-Trent
1897		Turnbull, Andrew, Ph.D. (Heidelberg), 18, Hackin's Hey Liverpool
1906	Trans.	Turnbull, Robert Hutchison, F.I.C., c/o Messrs. MacAndrews and Forbes Co., 3rd-street and Jefferson-avenue, Camden, N.J., U.S.A.
1886		Turner, Arthur, The Limes, Aylesbury
1897		Turner, Basil William, 83, Pitt-street, Sydney, N.S.W.
1896		Turner, Benjamin Bernard, B.Sc. (Lond.), Ph.D. (Göttingen), 261, W. Hoffmann-street, Baltimore, Md., U.S.A.
1888	Trans.	Turner, Charles, 225A, Oxford-street, Manchester
1906		Turner, George Augustus, 12, The Foregate, Worcester
1897		Turner, John Scriven, 20, Bury-street, Bloomsbury, W.C.

Date of Election.			
1883	Trans.		‖Turner, Thomas, Prof., M.Sc. (Vict.), A.R.S.M., F.I.C., The University, Edgbaston, Birmingham
1903	Trans.		Turner, William Ernest Stephen, M.Sc. (Birm.), B.Sc. (Lond.), The University, Sheffield
1889	Trans.		Turpin, George Sherbrooke, M.A. (Cantab.), D.Sc. (Lond.), High School, Nottingham
1871			‖Tustin, John Robert, Albion House, The Marina, Deal
1905	Trans.		Tutin, Frank, 9, Haverfield-gardens, Kew, Surrey
1888	Trans.	C. 1909-	Tutton, Alfred Edwin Howard, M.A. and D.Sc. (Oxon.), F.R.S., 41, Ladbroke-square, W.
1892			Tweedie, Thomas Shortridge, Trensano, Annan, N.B.
1907			Twiney, William George, B.Sc. (Lond.), Stoneleigh, Blenheim-road, Caversham, Reading
1904	Trans.		Twiss, Douglas Frank, M.Sc. (Birm.), F.I.C., The Municipal Technical School, Suffolk-street, Birmingham
1899	Trans.		Tyler, Ernest Albert, B.A. (Cantab.), 33, The Promenade, Mount Pleasant, Swansea
1876			Typke, Paul George William, F.I.C., Lawn House, New Malden, Surrey
1876			Tyrer, Thomas, F.I.C., Stirling Chemical Works, Abbey-lane, Stratford, E.
1903			Tyrrell, Dennis, 182, King-street, Norwich
1908			Tyson, Thomas Marshall, 109, Carpenters-road, Stratford, E.
1876			‖Udall, Thomas Bertram, Newcastle-under-Lyme, Staffs.
1865			Umney, Charles, F.I.C., 50, Southwark-street, S.E.
1893	Trans.		Umney, John Charles, 50, Southwark-street, S.E.
1889			‖Underhill, Thomas John, Stanley, Quernmore-road, Bromley, Kent
1904			Underhill, William Wood, 10, Hartham-road, Holloway, N.
1897			‖Unwalla, Rustomji Navroji, Medical Dept., Bhaunagar, Kathiawâr, India
1908			Unwin, Harry James, Egstow, Market-place, Clay Cross, Chesterfield
1909	Trans.		Usher, Francis Lawry, B.Sc. (Lond.), Brooklyn, Hornsey-lane, N.
1882			‖Vacher, Francis, F.R.C.S., and M.R.C.P. (Edin.), c/o Dr. Kenyon, Flookersbrook, Chester
1890			Valentin, Basil William, Messrs. Buckley Bros., Brewery, Llanelly, S. Wales
1903			Van Laer, Norbert, c/o Messrs. Truman, Hanbury, Buxton and Co., Ltd., Burton-on-Trent

Date of Election.			
1901			Varley, Harold Fay Fleetwood, 3, Sunset-view, Ilkley
1909			Varley, Reginald Wells, c/o Leys Malleable Castings Co., Ltd, Derby
1883			Vasey, Samuel Archibald, F.I.C., Beechcroft, Burnt Ash-lane, Bromley, Kent
1894			Vaux, Cuthbert, 11, Thornhill-park, Sunderland
1879	Trans.		Veley, Victor Herbert, M.A. and D.Sc. (Oxon.), F.R.S., 8, Marlborough-place, N.W.
1891			Velling, Frederick William de, B.A., Higher Grade Board School, The Boulevard, Hull
1881			Venable, Francis Preston, Ph.D. (Göttingen), Chapel Hill, North Carolina, U.S.A.
1887			‖Vergara, Vargas José Maria, Apartado No. 237, Bogotá, Colombia
1901			Verteuil, Joseph de, Clarence-street, Port of Spain, Trinidad, British West Indies
1897			Viccajee, Framjee Khurshedjee, c/o Messrs. King, King & Co., P.O. Box 110, Fort, Bombay, India
1908			Vidyant, Hari Prasad, M.A. (Allahabad), C.E., Executive Engineer, Muckbulganj, Lucknow, India
1884			‖Voelcker, Edward William, A.R.S.M., F.I.C., 22, Tudor-street, Blackfriars, E.C.
1884		C.1891-5, 1902-04	‖Voelcker, John Augustus, Hon. M.A. (Cantab.), Ph.D. (Giessen), B.A. and B.Sc. (Lond.), F.I.C., 20, Upper Phillimore-gardens, Kensington, W.
1889			‖Voss, Walter Arthur, Eastwood-road, Rayleigh, Essex
1885			Vulté, Hermann T., Ph.D., Columbia University, New York City, U.S.A.
1901			‖Wade, Frank, A.R.C.S., F.I.C., 26, St. Ronan's-avenue, Southsea; and Laboratory, H.M. Dockyard, Portsmouth
1890	Trans.	C.1905-09	‖Wade, John, D.Sc. (Lond.), F.I.C., Hunstanton Lodge, Downe, Kent; and Guy's Hospital, London Bridge, S.E.
1903	Trans.		Wadmore, John Mello, M.A. (Oxon.), Aldenham School, near Elstree, Herts.
1901			Wager, Morton Ethelred, B.Sc. (Lond.), Holme Cottage, Mytholmroyd, S.O., Yorks.
1894			‖Wagner, William George, 12, North Common-road, Ealing, W.
1893			Wait, Charles E., Prof., University of Tennessee, Knoxville, U.S.A.
1888			‖Wait, Frank Goodell, Geological Survey Department, Ottawa, Canada
1899			Walden, Allan Frederick, M.A. (Oxon.), 37, High-street, and New College, Oxford

Date of Election.			
1897			Walford, Samuel Matthew, Wyncote, Hatherlow, Stockport
1881			‖Walker, Archibald, M.A. (Oxon.), F.I.C., Newark Castle, Ayr, N.B.
1898	Trans.		‖Walker, Andrew Jamieson, Ph.D. (Heidelberg), B.A. (Dub.), 37, Charnwood-street, and Municipal Technical College, Derby
1899			Walker, Charles, Kuranda, Waverley-street, Waverley, N.S.W.
1894	Trans.		Walker, Charles Henry Hirst, M.A. (Oxon.), 1, Victoria-terrace, Corkickle, Whitehaven
1889			Walker, Daniel, School of Mines, Ballarat, Victoria, Australia
1906			Walker, Franklin Wilfred, 48, Blandford-road, Bedford Park, W.
1909			Walker, George Bilderbeck, Vale House, Trafalgar-road, Greenwich, S.E.
1908			Walker, Herbert, Whyttington, Station-road, Wealdstone, N.W.
1890	Trans.	C 1899-04 V.P. 1909-	‖Walker, James, Prof., D.Sc. (Edin.), Ph.D. (Leipzig), F.R.S., The University, and 5, Wester Coates-road, Edinburgh
1890			Walker, James Samuel Hourston, M.B. and C.M., (Edin.), D.P.H. (Cantab.), Clinical Research Association, Watergate House, Adelphi, W.C.
1897	Trans.		Walker, James Wallace, Prof., M.A., Ph.D., McGill University Montreal, Canada
1888			Walker, John Thom Ainslie, 64, Cannon-street, E.C.
1881			Walker, Robert William, Gossefield, Moss-lane, Ashton-on-Mersey, Manchester
1903			Walker-Pole, Miles, 71, De Korle-street, Braamfontein, Johannesburg, S. Africa
1905			Wall, Francis Henry, 1, Part-street, Southport
1884			‖Wallace, Robert, Prof., The University, Edinburgh
1878			‖Waller, Elwyn, A.M. (Harvard), Ph.D. (Columbia), 7, Franklin-place, Morristown, N.J., U.S.A.
1904			Walling, Léon Edward, 16, Beechhill-road, Eltham, Kent
1902			‖Wallis, Thomas Edward, B.Sc. (Lond.), F.I.C., 96, Stephens-road, Tunbridge Wells, Kent
1883			‖Walmsley, Robert Mullineux, D.Sc. (Lond.), Northampton Institute, St. John-street, Clerkenwell, E.C.; and 23, Hilldrop-road, Camden-road, N.
1905	Proc.		Walpole, George Stanley, B.Sc. (Melbourne), A.I.C., The Wellcome Physiological Research Laboratories, Brockwell Hall, Herne Hill, S.E.
1888			Walrond, Edward Dalrymple, M.A. (Cantab.), North Eastern County School, Barnard Castle, Durham
1903			Walsh, Thomas Crosbie, 42, Muswell-avenue, Muswell Hill, N.
1899			Walton, Robert Hawks, Flinders, Martin's-avenue, Bondi, Sydney, N.S.W.

Date of Election.		
1908		Walton, Sidney Gilbert, Kensington, Northwood-road, Northwood, Lane Cove River, N.S.W.
1884		‖Walton, Thomas Utrick, B.Sc. (Glas.), F.I.C., Colonial Sugar Refining Co., Sydney, N.S.W.
1905		Want, William Phillip, 11, Pearfield-road, Forest Hill, S.E.
1864		Ward, George, F.I.C., Buckingham-terrace, Headingley, Leeds
1908		Ward, Herbert Horace, University College of Wales, Aberystwyth
1891		Ward, Thomas Armistead, 15, Exchange-street, Blackburn
1907		Warner, Charles Horne, A.I.C., 24, Gordon-street, Gordon-square, W.C.
1871		Warner, George Joseph, Halton Villa, Widnes
1906		Warren, Richard Alfred, Belle Vue, Hallow-road, Worcester
1888		Warrick, Frederic Walmsley, 6, Nile-street, City-road, N.
1895		Warrington, Thomas Cotterill, M.A. (Oxon.), 29, Stockwell-street, Leek, Staffs.
1909		Warwick, Guy Ransom, B.A. (Cantab.), 5 and 6, Fowkes-buildings, Great Tower-street, E.C.
1906		Wasteneys, Hardolph, Department of Physiology, University of California, Berkeley, Cal., U.S.A.
1882		Waterfall, Charles James, F.I.C., 4, Queen-square, Bristol
1901		‖Waterhouse, James, Major-General, I.S.C., Hurstmead, High-street, Eltham, Kent
1907		Watkins, Charles Rowlatt, B.A. (Cantab.), Imperial Customs Service, Custom House, Bombay, India.
1908		Watkins, Edwin John, 10, Montpelier-road, Queen's-road, Peckham, S.E.
1885		‖Watson, Charles, Fairfield, Washwood Heath-road, Birmingham
1904	Trans.	Watson, Edwin Roy, M.A. (Cantab.), B.Sc. (Lond.), Dacca College, Dacca, Eastern Bengal, India
1887		‖Watson, Frederick Percy, 6 and 7, Bailgate, Lincoln
1899		Watson, Fred Sheasby, B.Sc. (Vict.), Sandgate, Villiers-road, Woodthorpe, Nottingham
1906		Watson, Frederick William, B.Sc. (Lond.), F.I.C., Consolidated Gold Fields of South Africa, Ltd., P.O. Box 108, Germiston, Transvaal, S. Africa
1907		Watson, George Arthur, A.R.C.S.I., Clongowes Wood College, Sallins, S.O., Co. Kildare, Ireland
1908	Trans.	Watson, Herbert Edmeston, B.Sc. (Lond.), A.I.C., Tringhurst, Cranes-park, Surbiton, B.O., Surrey
1904		Watson, Herbert Wood, B.Sc. (Vict.), Rose Villa, Roper-avenue, Gledhow, Leeds
1908		Watson, John, B.Sc. (Dun.), Dauntsey Agricultural School, West Lavington, Littleton Panell, Wilts.
1906		Watson, John Adam, 8, Powis-gardens, Notting Hill, W.

Date of Election.		
1883		‖Watson, Thomas Donald, 16, St. Mary's-road, Bayswater, W.
1876	Trans.	‖Watson, William Henry, J.P., Braystones House, Beckermet, Cumberland
1877		Watt, Alexander, F.I.C., c/o Messrs. Macfie and Sons, 34, Moorfields, Liverpool
1904		Watt, Francis Langston, A.R.C.S., F.I.C., Russenden, Stanley-street, Epping, near Sydney, N.S.W.
1906		Watt, George Gordon, 26, Albert-square, Clapham-road, S.W.
1906	Trans.	Watt, Henry Edgar, D.Sc. (Dun.), F.I.C., Blandfield Chemical Works, Wheatfield-road, Edinburgh
1908		Watt, John, Rev., M.A. (Aberd.), 2, Cornwallis-Square, Calcutta, India
1908		Watt, Robert Dickie, M.A. and B.Sc. (Glas.), c/o Department of Agriculture, P.O. Box 434, Pretoria, Transvaal, S. Africa
1883	Trans.	Watts, Francis, C.M.G., D.Sc. (Birm.), F.I.C., Imperial Commissioner of Agriculture for the West Indies, Barbados, West Indies
1906		Watts, James Neill, P.O., Eikenhof, Johannesburg, S. Africa
1872	Trans.	‖Watts, John, M.A. (Oxon.), D.Sc. (Lond.), F.I.C., Merton College, Oxford
1878	Trans.	Watts, John Isaac, Beechfield, Hartford, Cheshire
1888		Way, Edward John, F.I.C., New Kleinfontein Co., Ltd., Benoni, Transvaal, S. Africa
1901		Wayland, William Abraham, 12, Albert-road, St. John's, S.E.
1902		Webb, Arthur James, M.A. (Oxon.), B.Sc. (Lond.), Assoc.M.Inst.Mech.E., c/o Messrs. Johnson, Matthey & Co., Ltd., 78, Hatton-garden, E.C.
1883	Trans.	Webster, Charles Stuart Stanford, F.I.C., Malvern House, Redland, Bristol
1909		Webster, John, F.I.C., Laboratory of Pathological Chemistry, St. Mary's Hospital, Paddington, W.
1906	Trans.	Wechsler, Elkan, Ph.D. (Würzburg), 59, Petherton-road, Canonbury, N.
1907		Wechsler, Marcus, D.Sc. (Grenoble), 136, Sinclair-road, Kensington, W.
1904		Weeks, Henry Bridges, F.I.C., The Retreat, Infield-park, Barrow-in-Furness
1908		Weighell, Arthur, Top Floor, Prince-building, Medows-street, Fort, Bombay, India
1905		Weiskopf, Eric Hartwig, Ph.D. (Toulouse), Dynamite Factory, Modderfontein, Transvaal, S. Africa
1903		Weiss, Carl Friederich Richard, M.A. and Ph.D., (Bâle), 8, Harp-lane, E.C.

Date of Election.		
1898		Weissmüller, Edward Charles, Hill Crest, The Heath, Runcorn
1901		Welch, George Edward, B.Sc. (Lond.), Grammar School, Wakefield
1888		Welch, John Cuthbert, c/o Cymru Copper Co., Ketchikan, Alaska, U.S.A.
1893		Welchman, Frank Ernest, 16, Carlton-road, Putney Hill, S.W.
1891		Wellington, Stephen Newcombe, Assoc.M.I.E.E., c/o Coke Ovens and By-Products Co., Ltd., 141-143, Palace-chambers, Westminster, S.W.
1884	Trans.	Wells, James S. Chester, Ph.D. (Columbia), 320 H. 83rd Street, New York City, U.S.A.
1890		Wells, Sydney Russell, M.D. and B.Sc. (Lond.), M.R.C.S. (Eng.), M.R.C.P. (Lond.), 16, Lower Seymour-street, Portman-square, W.
1903		Welsford, Giles Haddon, Royal Gunpowder Factory, Waltham Abbey, Essex
1897		Welsh, John, M.R.C.S. (Eng.), L.R.C.P. (Lond.), 43, Tarvin-road, Chester
1888	Trans.	Werner, Emil Alphonse, F.I.C., 5, Church-avenue, Rathmines, Dublin
1886		‖Wertheimer, Julius, Prof., B.A. and B.Sc. (Lond.), F.I.C., Merchant Venturers' Technical College, Bristol
1897	Trans.	West, Charles Alfred, A.R.C.S., F.I.C., 9, Tideswell-road, Putney, S.W.
1899		West, George Hardstaff, B.Sc. (Lond.), County School, Pembroke Dock
1902		West, Joseph, Fernleigh, Lawton, Cheshire
1909		West, Percy Charles Henry, 33, Arpley-street, Warrington.
1898		Weston, Frank Edwin, 43, Larkhall-rise, Clapham, S.W.
1892		Whalley, Lawrence John de, 148, Jerningham-road, New Cross, S.E.
1893		Whalley, Sidney, B.Sc. (Lond.), 18, Nevilledale-terrace, Durham
1908		Wheatley, William, B.A. (Oxon.), 21, Bairstow-street, Preston, Lancs.
1906		Wheaton, Harold Joseph, 21, Chesterton-road, Cambridge
1907		Wheeler, Edward, A.C.G.I., 113, Highbury-quadrant, N.
1902		Wheeler, Edward J., Ph.D., 79, Chapel-street, Albany, N.Y., U.S.A.
1905		Wheeler, Ernest, c/o Messrs. Crossley Bros., Openshaw, Manchester
1894		Wheeler, Henry Lord, Ph.D. (Yale), The Sheffield Laboratory, New Haven, Conn., U.S.A.
1893		‖Wheeler, William Ernest, 33, Haverstock-road, Knowle, Bristol

Date of Election		
1897		Wheelwright, Edwin Whitfield, B.A. (Oxon.), Ph.D. (Munich), F.I.C., Greenholme, 24, Stanmore-road, Edgbaston, Birmingham
1879		Whitaker, Thorp, Bradford Dyers' Association, Ltd., Bradford
1897		White, Arthur James, 243, Albert-road, Jarrow-on-Tyne
1891		White, Henry, 245, Western-road, Crookes, Sheffield
1893		White, Henry Clay, Prof., Ph.D. (Virginia), Hon. D.C.L. (Univ. South), Hon. LL.D. (Illinois), University, Athens, Georgia, U.S.A.
1899		White, Henry Fox, 52, Royal York-crescent, Clifton, Bristol
1905		White, John Ledger, D.Sc. (Dun.), 9, Sugden-road, Lavender Hill, S.W.; and Battersea Polytechnic, Battersea Park-road, S.W.
1889		‖White, John Tsawoo, M.A. (Calcutta), Pyinmana, Upper Burma, India
1905		White, John William, B.Sc. (Lond.), c/o The E.C. Powder Co., Green Street Green, Dartford
1897		White, Paul Thomas, Hortonfield House, West Drayton, Middlesex
1902		White, William Carter, Glenholme, Longlands-park-road, Sidcup, S.O., Kent
1893		‖White, William Gilchrist, Vicarage View, 133, Tottington-road, Bury, Lancs.
1885		Whitehead, Henry Hammond, 18, Boston-road, Brentford
1896		Whitehead, James, 8, West-street, Rochdale
1901		Whitehouse, Philip Lewington, c/o Messrs. W. H. Keys, Ltd., Hall End Works, West Bromwich
1889		‖Whitehouse, William, Albany House, Bradmore, Wolverhampton
1904	Trans.	Whiteley, Charles Edward, 21, Brudenell-view, Leeds
1886	Proc.	‖Whiteley, Richard Lloyd, F.I.C., Municipal Science and Technical School, West Bromwich
1892		Whiteside, John Lowe, 376, St. Helen's-road, Bolton
1863		‖Whitfield, John, 113, Westborough, Scarborough
1899		Whittaker, Christopher Joseph, West Bank, Lytham
1889		Whittam, Matthew, M.A. (Cantab.), 75, Creffield-road, West Acton, W.
1901		Whittle, James, 30, Bridge-street, Morpeth
1907		Whymper, Robert, A.C.G.I., St. Clare, St. Mary's-road, Ditton Hill, Surrey
1900		Wiechmann, Ferdinand Gerard, Ph.D. (Columbia), P.O. Box 79, Station W., Brooklyn, N.Y., U.S.A.
1906		Wiffen, Henry John, 17, Albany-road, Manor-park, E.
1889		Wigan, Basil Penwarne, Rhondda Valley Brewery Co., Treherbert, Pontypridd
1905		Wigginton, John Henry Becker, 7, Byfeld-gardens, Barnes, S.W.

Date of Election.			
1907			Wight, Robert Burt, M.A. (Cantab.), 114, Grange-road, Middlesbrough
1906			Wightman, Charles, 36, Curzon-street, W.
1896	Proc.		Wigner, John Harrison, Ph.D. (Heidelberg), 54, Keptie-street, Arbroath, N.B.
1896			Wilcox, Alfred James, Rev., Shapwick, Blandford
1891			‖Wild, John, B.Sc. (Vict.), A.I.C., Bredbury House, Bredbury, Stockport
1909			Wild, Thomas Jabez, c/o Messrs. Scotts' Laboratories, Southall
1898			‖Wild, William Ernest, B.Sc. (Vict.), Alexander-villas, Talbot-road, Glossop
1898			Wilder, Frederick Louis, Villa Nova de Lima, Minas Geraes, Brazil
1897	Trans.		Wilderman, Meyer, Ph.D. (Freiburg), B.Sc. (Oxon.), Davy-Faraday Research Laboratory, Albemarle-street, W.
1902	Trans.		Wilkinson, Edward John, 24, Bertram-road, Manningham, Bradford
1904			Wilkinson, James Alfred, M.A. (Cantab.), Transvaal University College, P.O. Box 1176, Johannesburg, S. Africa
1903			Wilkinson, James Bates, M.D. and C.M. (Edin.), D.P.H. (Vict.), Town Hall, Oldham
1893			Wilkinson, John, Corporation Gas Works, Halifax
1905			Wilkinson, John Wells, M.A. (Wales), Longhope, Essendene-road, Belvedere, S.O., Kent
1891			Will, Wilhelm, Prof., Ph.D. (Berlin), Colonie Grunewald, Boothstrasse 32, bei Berlin, Germany
1904	Proc.		Willcox, William Henry, M.D., B.Sc., M.R.C.P. and L.S.A. (Lond.), D.P.H. (Eng.), F.I.C., St. Mary's Hospital, Paddington, W.
1906			Willett, Herbert William Mills, The Cedars, Chislehurst, Kent
1905			Williams, Alan Herbert, 100, Church-road, Urmston, Lancs.
1862	Trans.		‖Williams, Charles Hanson Greville, F.R.S., Bay Cottage, Smallfields, near Horley, Surrey
1903			Williams, David John, Bath and West of England College of Chemistry and Pharmacy, 6, Cleveland-place, East Bath
1908			Williams, David Thomas, 42, Finsbury-square, E.C.
1895			Williams, Evan, Bradford-road Gas Works, Manchester
1908			Williams, Frederick, B.A. (Oxon.), Bute Villa, Aberdare, S. Wales
1905			Williams, Gerard William, c/o The Ida H. Gold Mining Co., viâ Laverton, Western Australia
1892			Williams, John, Government Laboratory, British Guiana
1908			Williams, Joseph Henry, 43, Prince's-road, Wimbledon, S.W.
1907	Proc.		Williams, Percy, B.Sc. (Lond.), c/o Wilhelmina Co., Pontianak, Dutch West Borneo
1883	Proc.		Williams, Rowland, F.I.C., Hale Cote, Albert-park, Lancaster

Date of Election.		
1891		Williams, Seward Whiting, c/o Messrs. Seabury and Johnson, East Orange, N.J., U.S.A.
1872		‖Williams, Thomas, Chemical Laboratory and Assay Office, 8, Victoria-street, Liverpool
1885	Trans.	‖Williams, Walter Collingwood, B.Sc. (Lond.), F.I.C., Beechfield, Roby, near Liverpool
1892		Williams, William, M.A., M.D., B.Ch., and D.P.H. (Oxon.), M.R.C.S. (Eng.), County Health Department, 9, The Parade, Cardiff; and Bryn Derw, 31, Victoria-road, Penarth
1899	Proc.	Williams, William Arthur, 36, Woodburn-terrace, Edinburgh
1874	Trans.	‖Williams, William Carleton, B.Sc. (Vict.), F.I.C., Broomgrove, Goring-on-Thames, Reading
1907		Williams, William Henry, Government Education Department, Hong Kong, China
1898		Williamson, John Alexander, The Croft, Chase Court-gardens, Enfield, Middlesex
1874	Trans.	‖Williamson, Robert, F.I.C., Messrs. Williamson and Corder, Ltd., Walker, Newcastle-on-Tyne
1886	Trans.	Williamson, Sidney, Ph.D. (Munich), F.I.C., c/o The Cooper Research Laboratory, Berkhamsted, Herts.
1898		Williamson, William, 94, Hainault-road, Leytonstone, N.E.
1907		Willott, David, B.Sc. (Lond.) Niton, Banstead-road, Carshalton, Surrey
1896		Wills, Edward Chaning, M.A. (Cantab.), Rockstone, near Dawlish, S. Devon
1909		Wills, Harry Sampson, 59, Caldecot-road, Denmark-hill, S.E.
1872		Wills, Joseph Lainson, 133, Midwood-street, Flatbush, Brooklyn, N.Y., U.S.A.
1906		Willstaetter, Richard, Prof., Ph.D. (Munich), Bergstrasse 25, Zürich V, Switzerland
1892	Trans.	Wilsmore, Norman Thomas Mortimer, D.Sc. (Melbourne), 126, Walm-lane, Willesden Green, N.W.
1885		Wilson, Alfred Charles, F.R.S.E., Borough Hall, Stockton-on-Tees
1879		‖Wilson, Charles Joseph, F.I.C., 14, Old Queen-street, Westminster, S.W.
1894		Wilson, Christopher, The Grammar School, Manchester
1883	Trans.	‖Wilson, David, M.A. and D.Sc. (Glas.), Carbeth, Killearn, Glasgow
1901		‖Wilson, Duncan Randolph, 109A, Whitehall-court, S.W.
1899	Proc.	Wilson, Frederick Robert Leyland, M.A. (Oxon.), Charterhouse, Godalming
1908		Wilson, Harry Percy, 3, Audley-road, Colchester
1875		‖Wilson, James, M.A. (Dub.), Barrister-at-Law, 2, Essex-court, Temple; and 121, Claremont-road, Forest Gate, Essex

Date of Election.		
1890		Wilson, James Mitchell, M.D. and C.M. (Glas.), D.P.H. (Cantab.), County Hall, Beverley
1901		Wilson, James Scott, M.D. and C.M. (Glas.), D.P.H. (Cantab.), Bradford-street, Walsall
1895	Proc.	Wilson, John, M.Sc. (Vict.), Battersea Polytechnic, S.W.
1899		Wilson, John, 153, Buckley-street, Footscray, Victoria, N.S.W.
1902		Wilson, Lyndon Charles, 31, Castle-gate, Newark-on-Trent
1900	Proc.	Wilson, Leonard Philip, 19, Widdrington-road, Coventry
1909	Trans.	Wilson, Robert William, 56, Dover-road, Wanstead Park Estate, Manor Park, E.
1871		‖Wilson, William John, c/o Dr. W. M. Watts, Shirley, Venner-road, Sydenham, S.E.
1907		Wilson, William John, A.C.G.I., 12, Vicarage-park, Plumstead, Kent
1884		Wilton, Thomas, The Gas Light and Coke Co., Beckton, North Woolwich, S.E.
1893		Winder, Edward Humphreys, Felton, Ludlow
1894		Wingate, Hamilton More, B.Sc. (Glas. and Melbourne), 71, Queenswood-road, Forest Hill, S.E.
1895		Wingfield, Thomas Rowland, 5, Bromwich-street, Bolton
1876		Winser, Percy James, F.I.C., Heath House, Knutsford
1908	Trans.	Winterson, William George, B.Sc. (Lond.), 89, Salisbury-road, Barnet
1906		Winther, Christian, Ph.D. (Copenhagen), Ostervold 5, Copenhagen, Denmark
1898	Trans.	Witham, Ernest, B.A. and B.Sc. (Lond.), The Grammar School, Rotherham
1908		Withey, William Henry, B.A. (Cantab.), Walpole House, Church-road, Teddington, Middlesex
1876	Trans.	‖Witt, Otto Nikolaus, Geh. Rath Prof., Dr., Ebereschenallee 10, Westend bei Berlin, Germany
1906		Wolfe, Ernest Edwin, Kinsale, Co. Cork, Ireland
1907		Wolff, Mark Arthur, Poderosa Mining Co., c/o Messrs. H. A. Bethell & Co., Antofagasta, Chile, S. America
1902		Womersley, Charles Edward, 7, Tidswell-street, Heckmondwike, S.O., Yorks.
1889		Wood, Charles, Rossemount, Emm-lane, Heaton, Bradford
1860	Trans.	‖Wood, Charles Henry, F.I.C., Erica, Bournemouth-road, Parkstone, S.O., Dorset
1908		Wood, Francis Charles Benjamin, Deurne, near Antwerp, Belgium
1902		Wood, Frank Stanley, Chin Chu, Heathcote-street, Newland, Hull
1898	Trans.	Wood, Thomas Barlow, Prof., M.A. (Cantab.), Gonville and Caius College, Cambridge

Date of Election.		
1903		‖Wood, William Francis John, B.Sc. (Lond.), Hazelhurst Doncaster-road, Barnsley
1900		Woodbridge, Walter Bourne, A.C.G.I., 36, Baker-street, Readin
1871	Trans.	Woodcock, Reginald C., F.I.C., The Sanitas Co., Ltd., Locksley-street, Limehouse, E.
1904		Woodcock, William Henry, 10, Chesson-road, W. Kensington, W.
1898		Woodhead, Samuel Allinson, B.Sc. (Dun.), F.I.C., Agricultura College, Uckfield, Sussex
1909		Woods, George James, 2, Wellmeadow-road, Lewisham, S.E.
1892		‖Woods, Hugh, B.A., M.D. and B.Ch. (Dub.), D.P.H., (R.C.P.S.I.), Red House, Bordyke, Tonbridge
1888		Woodward, James, B.A. and B.Sc. (Lond.), F.I.C., Drummon House, 31, Coventry-road, Ilford, Essex
1889		Woolf, Mortimer, Mayfield, Mortimer-road, N.W.
1903		Woolhouse, Sidney Herbert, M.A. and B.Sc. (Dub.), A.R.C.S.I., 5, Latymer-road, Lower Edmonton, N.
1889		Woosnam, Richard William, F.I.C., 1, The Chase, Warb Mount, Brentwood, Essex
1908	Trans.	Wootton, Hubert Arthur, M.A. (Cantab.), B.Sc. (Lond.), 20, Great College-street, Westminster, S.W.
1908	Trans.	Wootton, William Ord, B.Sc. (Lond.), A.R.C.S., 159, Maidstone-road, Rochester
1903		Worden, Edward Chancey, M.A. (N.Y.), Clark Thread Co., Newark, N.J., U.S.A.
1908	Trans.	Worley, Frederick Palliser, M.A. and M.Sc. (N.Z.), Mansfiel House, Clifton-gardens, Maida Hill, W.
1884		‖Worrall, Jason Hall, F.I.C., Howsley, Chapeltown, near Sheffiel
1858		‖Worsley, Philip John, Rodney Lodge, Clifton, Bristol
1906		Wortley, Edward Jocelyn, Rectory, Half-way-tree, Jamaica
1906	Trans.	Wren, Henry, M.A. (Oxon.), B.Sc. (Lond.), Ph.D. (Tübingen), 22, Stapleton-hall-road, Stroud Green, N.
1905		Wren, William James, A.R.C.S., Hilton College, near Maritzburg, Natal, S. Africa
1898		Wrench, Charles Arthur, 95A, Southwark-street, S.E.
1908		Wright, Allister MacLean, P.O. Box 617, Christchurch, New Zealand
1908		Wright, Charles Harold, B.A. (Cantab.), A.I.C., Governmen Laboratory, Port of Spain, Trinidad, British West Indies
1895		Wright, Harold Edward, c/o Sir B. Samuelson and Co., Ltd., Middlesbrough
1878	Trans.	Wright, Lewis Thompson, 10, Linden-gardens, Bayswater, W.
1894		Wright, Robert, 5, Devonshire-colonnade, Buxton
1886	Trans.	‖Wright, William Thomas, 11, Rundle-road, Sheffield

Date of Election.			
1864			‖Wrightson, John, Prof., Charford, Manor House, Downton, Salisbury
1880			Wyborn, John Middleton, Shoulden, Farnaby-road, Bromley, Kent
1884			‖Wyley, William Fitzthomas, Wheatley-street, Coventry
1885	Trans.	C. 1892-6, S.1898-99, 1903-05, V.-P 1905-08.	‖Wynne, William Palmer, Prof., D.Sc. (Lond.), F.R.S., F.I.C., A.R.C.S., The University, and 17, Taptonville-road, Sheffield
1908			Yates, Harry James, M.Sc. (Manc.), F.I.C., Redcroft, Four Oaks Warwickshire
1908	Trans.		Yates, Joseph, B.Sc. (Lond.), Municipal Technical School, Blackburn
1886	Trans.		Yoshida, Hikorokurō, Prof., Imperial University of Kyoto, Kyoto, Japan
1885			Young, Alfred Collett, 17, Vicar's-hill, Lewisham, S.E.
1903			Young, Andrew, M.A. and B.Sc. (Edin.), Geological Department, South African College, and 5, Rosmead-avenue, Cape Town, S. Africa
1886			‖Young, Brougham, 2A, Sigdon-road, Dalston-rise, N.E.
1908	Trans.		Young, Charles Robert, B.Sc. (Lond.), 11, Low-pavement, Nottingham
1897			Young, Francis Samuel, M.A. (Oxon.), F.I.C., The College, Bishop's Stortford
1877			‖Young, Frank Watson, F.R.S.E., 32, Buckingham-terrace, Botanic-gardens, Glasgow
1890	Trans.		‖Young, George, Ph.D. (Erlangen), F.I.C., 79, Harvard-court-mansions, Honeybourne-road, West Hampstead, N.W.
1895			Young, Henry Stow, F.I.C., c/o The Borneo Co., Ltd., Kuching, Sarawak
1894			Young, James, 12, Edge-hill, Plumstead, Kent
1874			Young, John, 164, Bath-street, Glasgow
1898			Young, John Henry, B.Sc. (Vict.), c/o Cassel Gold Extracting Co., Ruehill-road, Maryhill, Glasgow
1877			‖Young, John Rymer, 21, Palmyra-square, Warrington
1887	Trans.		Young, John William, B.A. and B.Sc. (Lond.), 3, Murray-street, Higher Broughton, Manchester
1882	Trans.	C. 1894-8.	‖Young, Sydney, Prof., D.Sc. (Lond.), B.Sc. (Manc.), Hon. Sc.D. (Dub.), F.R.S., F.I.C., Trinity College, Dublin
1902			Young, Thomas Arthur, 11, Hampshire-street, Cheetham, Manchester

Date of Election.			
1907			Young, Walter Ormston, 14, Normanton-terrace, Newcastle-on-Tyne
1873			‖Young, William Charles, F.I.C., 2, Queen Anne's-grove, Bedford Park, W.; and Chemical Laboratory, 19/20, Aldgate, E.C.
1907	Trans.		Zortman, Israel Hyman, B.Sc. (Vict.), Ph.D. (Leipzig), 13, Skinner-lane, Leeds

Number of Honorary and Foreign Members	...	33
,, ,, Fellows	...	2981 5

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

PROCEEDINGS

OF

THE CHEMICAL SOCIETY.

Vol. XXVI. Nos. 365—379.
JANUARY—DECEMBER, 1910.

LONDON:
GURNEY & JACKSON, 10, PATERNOSTER ROW.
1911.

Richard Clay and Sons, Limited,
BREAD STREET HILL, E.C., AND
BUNGAY SUFFOLK.

LIST OF GRANTS MADE FROM THE RESEARCH FUND DURING THE YEAR 1910.

£6 to G. H. J. Adlam : atomic weight determinations.

£5 to W. C. Ball : bismuthinitrites.

£10 to C. O. Bannister : action of various admixtures made with ore in roasting processes for galena.

£5 to N. Bland : berberinal, oxyberberine, and dihydroberberine.

£5 to O. L. Brady : composition and constitution of aconitine.

£5 to H. Browning, jun. : synthetic formation of closed chains.

£5 to H. T. Clarke : mutual influence of unsaturated atoms in open chain and cyclic organic compounds.

£10 to A. Clayton : preparation and constitution of coumarinic acids (continued).

£5 to W. W. Close : kinetics of reactions of carboxylic acids, phenols, aldehydes, and ketones.

£5 to J. B. Cohen : the space formula for quinquevalent nitrogen.

£5 to C. H. Desch : process of diffusion in solid substances (continued).

£7 to Miss M. E. Dobson : attempt to synthesise berberine (continued).

£15 to J. G. M. Dunlop : preparation of 3 : 3-dimethyl-1-trimethylenepiperidinium iodide.

£7 to F. P. Dunn : stereoisomerism of the oximes.

£5 to A. E. Dunstan : relation between viscosity and chemical constitution (continued).

£7 to A. E. Dunstan : correlation of viscosity and other physical properties.

£5 to A. J. Ewins : mutual solubility of liquids.

£6 to T. Ferns : reactions of some derivatives of sulphonic acids.

£10 5. 8. to J. A. N. Friend : corrosion of metals.

£15 to C. S. Gibson : resolution of substances containing asymmetric atoms of nitrogen, phosphorus, and other elements of the same group into their optically active components.

£5 to C. Gilling : hydroaromatic ketones (continued).

£5 to W. Godden : isocoumarin.

£5 3. to P. Haas : action of bromine on hippuric acid.

£5 to V. J. Harding : substitution of derivatives of aromatic hydroxy-compounds.

£20 to W. N. Haworth: constitution of sylvestrene. Synthesis of camphenilene, norcamphor, and fenchene.

£8 to A. Holt, jun.: atomic weight of phosphorus.

£10 to F. Holt: preparation of $\alpha\alpha'$-dibrom-β-methyladipic acid and its transformation into β-methylpyrrolidine.

£7 to E. Hope: synthesis of methylbutanetricarboxylic acids.

£15 to E. Hope: condensation of nitromeconine, nitrophthalide, and other nitro-compounds with cotarnine.

£5 to W. J. Jarrard: mellitic acid and its derivatives.

£10 to F. R. Lankshear: compounds of manganese.

£10 to A. Lapworth: attempt to synthesise compounds related to norpinic acid.

£7 to H. R. Le Sueur: preparation of secondary amines from carboxylic acids.

£7 to T. M. Lowry: dynamic isomerism (continued).

£15 5. to W. H. Mills: stereoisomeric investigation of hydrazones, phenylhydrazones, and carbazones.

£10 to J. R. Partington: state of ionisable solutes in absolute alcohol.

£5 to W. H. Patterson: nature of occluded hydrogen, etc.

£5 to S. P. U. Pickering: nature of cupri-compounds.

£10 to J. N. Pring: union of carbon and hydrogen at high temperatures.

£5 to W. M. Roberts: guaiacol and its derivatives.

£10 to R. Robinson: synthesis of hydrastine.

£10 to N. V. Sidgwick: measurement of the rate of hydration of acid anhydrides.

£10 to J. L. Simonsen: certain tetramethylbenzenes.

£10 4. 8. to S. Smiles: action of sulphuric acid on certain hydroxy-aromatic sulphoxides.

£10 to A. W. Stewart: influence of conjugation on absorption spectra.

£5 to J. J. Sudborough: influence of double bonds on the rate of chemical reactions.

£5 to F. B. Thole: relation between viscosity and chemical constitution.

£6 to Miss G. M. Walsh: condensation of 1-methyl methoxy-4-ethyl carbonate acetophenone with piperidine, and the investigation of certain organic substances which may possess some value as perfumes.

Total amount granted during 1910 = £378. 18. 4.

LIST OF FELLOWS ELECTED DURING 1910.

Name.	Proposed.	Elected.
Adams, Percival Frederick	December 16th, 1909	February 17th.
Applebey, Malcolm Percival	October 20th, 1910	December 1st.
Auchinleck, Gilbert Grahame	December 2nd, 1909	February 17th.
Banerjee, Manindranath	October 20th, 1910	December 1st.
Banister, Fred	December 2nd, 1909	February 17th.
Barwick, Fred Wilkinson	October 20th, 1910	December 1st.
Batley, Ward Allen	May 26th, 1910	June 16th.
Baume, Georges	March 3rd, 1910	May 5th.
Berens, Herbert Arthur	January 20th, 1910	February 17th.
Bethwaite, John	March 17th, 1910	May 5th.
Bhattacharya, Sarat Chandra	October 20th, 1910	December 1st.
Bosworth, Stewart McGregor	,, ,, ,,	,, ,,
Bourdillon, Robert Benedict	February 17th, 1910	May 5th.
Bracewell, Geoffrey Alfred	April 21st, 1910	June 16th.
Bracher, André	October 20th, 1910	December 1st.
Brady, Frederick Hugh Rochfort	,, ,, ,,	,, ,,
Brady, Oscar Lisle	March 3rd, 1910	May 5th.
Briggs, John C.	October 20th, 1910	December 1st.
Briscoe, Henry Vincent Aird	June 16th, 1910	,, ,,
Brown, John	October 20th, 1910	,, ,,
Buchner, Eduard	January 20th, 1910	February 17th.
Buswell, Henry Leslie Farmer	March 3rd, 1910	May 5th.
Buttle, Bertram Haward	November 3rd, 1910	December 1st.
Camp, Frank Anthony	November 3rd, 1910	December 1st.
Canton, Howard	December 2nd, 1909	February 17th.
Cardoso, Ettore	February 17th, 1910	May 5th.
Challenger, Frederick	October 20th, 1910	December 1st.
Cheetham, Thomas Patrick	March 3rd, 1910	May 5th.
Child, Arthur James	January 20th, 1910	February 17th.
Clarke, Herbert Edmund	February 3rd, 1910	May 5th.
Cocks, Reginald Henry	January 20th, 1910	February 17th.
Colgate, Reginald Thomas	October 20th, 1910	December 1st.
Collet, Ronald Leslie	May 26th, 1910	June 16th.
Cooper, Leonard Harry	January 20th, 1910	February 17th.
Coslett, Thomas Watts	October 20th, 1910	December 1st.
Coventry, Bernard Okes	January 20th, 1910	February 17th.
Cram, Marshall Perley	November 17th, 1910	December 1st.
Crawford, David Chalmers	,, 3rd, 1910	,, ,,
Crichton, Charles	,, 17th, 1910	,, ,,
Cumming, Alexander Charles	December 16th, 1909	February 17th.
Dand, Middleton Henry	May 5th, 1910	June 16th.
Das, Tarak Nas	December 16th, 1909	February 17th.
Davies, John Hughes	October 20th, 1910	December 1st.
Dickson, Thomas William	March 3rd, 1910	May 5th.

Name.	Proposed.	Elected.
Dodd, Alexander Scott	April 21st, 1910	June 16th.
Dodd, Arthur	November 3rd, 1910	December 1st.
Duncan, James Hugh	October 20th, 1910	,, ,,
Emmett, William Gidley	October 20th, 1910	December 1st.
Emslie, Benjamin Leslie	January 20th, 1910	February 17th.
Ensor, Ainslie Jackson	October 20th, 1910	December 1st.
Everest, Arthur Ernest	December 16th, 1909	February 17th.
Farrands, Harry	March 17th, 1910	May 5th.
Finlayson, John George	October 20th, 1910	December 1st.
Forster, Aquila	December 16th, 1909	February 17th.
Garland, Charles Samuel	March 17th, 1910	May 5th.
Goddon, George Alexander	October 20th, 1910	December 1st.
Goldsbrough, Harold Albert	March 3rd, 1910	May 5th.
Gramont, Count Arnaud de	November 17th, 1910	December 1st.
Grieve, James	April 21st, 1910	June 16th.
Guhlmann, Charles Frederick	May 26th, 1910	,, ,,
Hackford, John Edward	May 5th, 1910	June 16th.
Handley, John	January 20th, 1910	February 17th.
Harrison, Edwin	March 17th, 1910	May 5th.
Haycock, John	April 21st, 1910	June 16th.
Hayhurst, Walter	January 20th, 1910	February 17th.
Holt, Fred	November 3rd, 1910	December 1st.
Huck, John	April 21st, 1910	June 16th.
Hughes, Herbert Hillier	December 2nd, 1909	February 17th.
Jacobs, Lionel Leslie	May 26th, 1910	June 16th.
Jaques, Arthur	November 18th, 1909	February 17th.
Jenkins, Leslie Charles W.	January 20th, 1910	,, ,,
Jones, William Jacob	February 3rd, 1910	May 5th.
Joshi, Govind Laxman	May 5th, 1910	June 16th.
Kenner, James	March 3rd, 1910	May 5th.
Khan, Prince Mahmood Ali	November 3rd, 1910	December 1st.
Knecht, Edmund	October 20th, 1910	,, ,,
Knight, William Arthur	,, ,, ,,	,, ,,
Krall, Hans	January 20th, 1910	February 17th
Kwoh, Sea-Kwain	March 3rd, 1910	May 5th.
Lamb, Samuel	March 3rd, 1910	May 5th.
Lambert, Bertram	October 20th, 1910	December 1st.
Lavender, John Herbert	January 20th, 1910	February 17th.
Leechman, Alleyne	November 17th, 1910	December 1st.
Lewis, Frederick Charles	February 3rd, 1910	May 5th.
Lewis, Samuel Judd	November 18th, 1909	February 17th.
Long, Frank Stevenson	May 5th, 1910	June 16th.
Longman, Charles Herbert Bell	February 17th, 1910	May 5th.
Low, Kenneth Stewart	October 20th, 1910	December 1st.
Lowe, Clement Ward	,, ,, ,,	,, ,,
Lucking, Hubert Leslie	February 3rd, 1910	May 5th.
McBeath, John William	December 16th, 1909	February 17th.
MacGeorge, David Jackson	June 16th, 1910	December 1st.

Name.	Proposed.	Elected.
McNish, Malcolm	October 20th, 1910...	December 1st.
Majima, Rikō	,, ,, ,,	,, ,,
Marean, Alexander	January 20th, 1910...	February 17th.
Martin, William Ernest	May 26th, 1910	June 16th.
Mason, Horace George	March 17th, 1910 ...	May 5th.
Masson, James Irvine Orme	October 20th, 1910...	December 1st.
Meanwell, Charles Wright	December 16th, 1909	February 17th.
Merton, Thomas R.	October 20th, 1910...	December 1st.
Mitchell, Alec Duncan	June 16th, 1910	,, ,,
Mitra, Dhirendranath	October 20th, 1910 ...	,, ,,
Moore, Harold	,, ,, ,,	,, ,,
Murch, Douglas Wilshin	December 2nd, 1909...	February 17th.
Myers, James Eckersley	November 3, 1910 ...	December 1st.
Nair, Valliyil Govindan	October 20th, 1910 ...	December 1st.
Narbeth, Benjamin Mason	May 26th, 1910	June 16th.
Neal, George Williams	January 20th, 1910...	February 17th.
Needs, Francis Edwin	March 17th, 1910	May 5th.
Newman, Sidney Herbert	November 3rd, 1910	December 1st.
Nicholson, Philip Brady	January 20th, 1910...	February 17th.
Oakley, Robert O'Field	May 26th, 1910	June 16th.
Palmer, Gilbert...	January 20th, 1910...	February 17th.
Paris, Edward Talbot	April 21st, 1910	June 16th.
Paterson, John Hamilton	October 20th, 1910 ...	December 1st.
Pennington, Alfred John	,, ,, ,,	,, ,,
Posford, Benjamin Ashwell	,, ,, ,,	,, ,,
Prasad, Hari	,, ,, ,,	,, ,,
Preston, Knowles	March 3rd, 1910	May 5th.
Ramsden, Frederick Valentine	October 20th, 1910 ...	December 1st.
Ransome, Alfred Oswald	November 3rd, 1910...	,, ,,
Rattey, Clifford Clare	January 20th, 1910...	February 17th.
Rau, Malur Srinivasa	,, ,, ,,	,, ,,
Reddie, John Alexander	May 26th, 1910	June 16th.
Reed, Walter William	May 5th, 1910...... ...	,, ,,
Rees, John James Beaumont	December 2nd, 1909	February 17th.
Rees, Thomas John	October 20th, 1910 ...	December 1st.
Rele, Gangaram Rajendrarao	,, ,, ,,	,, ,,
Ridgway, Joseph	,, ,, ,,	,, ,,
Robinson, James Beglar	,, ,, ,,	,, ,,
Rose, John George	May 5th, 1910.........	June 16th.
Russell, John	January 20th, 1910...	February 17th.
Sen, Aswini Kumar	January 20th, 1910...	February 17th.
Sen, Rajendra Nath	November 3rd, 1910	December 1st.
Shah, Motilal Kashalchand	March 3rd, 1910	May 5th.
Sharpe, Frederick Herbert	October 20th, 1910 ...	December 1st.
Sinclair, St. Clair Overbeck	May 5th, 1910	June 16th.
Slade, Roland Edgar	April 21st, 1910	,, ,,
Smith, Ernest William	January 20th, 1910...	February 17th.
Smith, James Harry	April 21st, 1910	June 16th.
Smith, Percy Lancelot James	October 20th, 1910 ...	December 1st.
Smith, Thomas May	April 21st, 1910	June 16th.
Smith, William James Pittock	June 16th, 1910.......	December 1st.

Name.	Proposed.	Elected.
Sorabji, Kaikhushroo Bamanji	May 26th, 1910	June 16th.
Southgate, Herbert William	November 18th, 1909	February 17th.
Srivastava, Jwala Prasad	October 20th, 1910...	December 1st.
Stedman, Ernest	May 26th, 1910	June 16th.
Stuart, Murray	January 20th, 1910...	February 17th.
Temperley, Claude Vareille..................	June 16th, 1910	December 1st.
Terrey, Augustus George.....................	October 20th, 1910...	,, ,,
Thole, Ferdinand Bernard	April 21st, 1910	June 16th.
Tschugaeff, Leo..................................	June 16th, 1910	December 1st.
Turbutt, Richard Babington	,, ,, ,,	,, ,,
Turner, Joseph	October 20th, 1910...	,, ,,
Vance, John Fleming Culun Brown	November 17th, 1910	December 1st.
Wallis, Robert Lauder Mackenzio	October 20th, 1910...	December 1st.
Ward, Percy George..............................	January 20th, 1910...	February 17th.
Williams, Arthur Bernard	November 3rd, 1910	December 1st.
Williams, Frederick George	April 21st, 1910	June 16th.
Williams, Herbert Goulding	June 16th, 1910	December 1st.
Williams, John....................................	May 26th, 1910	June 16th
Wolfenden, Stuart Jardine Norris.........	November 18th, 1909	February 17th.
Wright, William Norman Stewart.........	June 16th, 1910	December 1st.
Young, John	January 20th, 1910...	February 17th.
Yusuf, Syed Muhammad......................	October 20th, 1910...	December 1st.

LIST OF FELLOWS DECEASED DURING 1910.

Name.	Elected.	Died.
Abegg, Richard	December 6th, 1906	April 3rd, 1910.
Barklie, Robert	December 1st, 1870	May 27th, 1910.
Benn, Robert Haslam Durward	May 5th, 1904	April 4th, 1910.
Blackburn, Thomas	October 2nd, 1886	March 10th, 1910.
Brown, James Campbell	March 7th, 1907	March 14th, 1910.
Bull, Benjamin Samuel	February 1st, 1898	July 4th, 1910.
*Cannizzaro, Stanislao	June 19th, 1862	May 10th, 1910.
Carteighe, Michael	June 16th, 1864	May 30th, 1910.
Croysdale, John	June 20th, 1895	March 11, 1909.
*Fittig, Rudolf	February 1st, 1883	November 19th, 1910.
Grundy, Frank Barnes	December 3rd, 1903	October 18th, 1910.
Guttmann, Oscar	December 2nd, 1897	August 2nd, 1910.
Hadley, Edwin Bernard	December 1st, 1898	August 26th, 1908.
*Landolt, Hans	February 2nd, 1888	March 14th, 1910.
Mackay, Angus	December 2nd, 1877	February 8th, 1910.
Palmer, Sir Walter, Bart.	April 17th, 1879	April 16th, 1910.
Phillips, Arthur Gaved	February 1st, 1887	April 17th, 1910.
Roberts, Richard Wightwick	April 4th, 1889	April 6th, 1910.
Udall, Thomas Bertram	April 6th, 1876	December 24th, 1909.
White, John Tsawoo	April 4th, 1889	1910.
Williams, Charles Hanson Greville	January 16th, 1862	July 15th, 1910.

* Honorary and Foreign Member.

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1. The alkaloids of ergot. Part II. By George Barger and Arthur James Ewins	2	284
2. The constituents of colocynth. By Frederick Belding Power and Charles Watson Moore	3	99
3. Organic derivatives of silicon. Part XII. Dibenzylethylpropylsilicane and sulphonic acids derived from it. By Frederick Challenger and Frederic Stanley Kipping	3	142
4. Formation of heterocyclic compounds. Part II. Action of bases on the $\alpha\alpha'$-dibromo-derivatives of certain dicarboxylic acids. By Henry Rondel Le Sueur and Paul Haas	4	173
5. The triazo-group. Part XI. Substituted triazomalonic and phenyltriazoacetic acids. By Martin Onslow Forster and Robert Müller	4	126
6. Iodobenzenemonosulphonic acids. Part II. Esters and salts of di- and tri-iodobenzenesulphonic acids. By Mary Boyle	4	211
7. The absorption spectra of naphthalene and of tetramethylnaphthalene. By Annie Homer and John Edward Purvis	5	280
8. The influence of various substituents on the optical activity of tartramide. Part III. Halogen-substituted anilides. By Percy Faraday Frankland and Douglas Frank-Twiss	5	154
9. The action of water of crystallisation on calcium carbide. By Irvine Masson	6	851
10. Decomposition of dimercurammonium nitrite by heat. By Prafulla Chandra Rây and A. C. Ghosh	6	323
11. The adsorption of uranium-X by barium sulphate. By Arthur John Berry	6	196
12. Experiments on the Walden inversion. Part III. Optically active β-hydroxy-β-phenylpropionic acids and the corresponding β-bromo-β-phenylpropionic acids. By Alex. McKenzie and Herbert Brooke Perren Humphries	7	121
13. The double nitrites of mercury and the metals of the alkaline earths. By Prafulla Chandra Rây	7	326
14. The resin acids of the Coniferae. Part II. Matairesinol. By Thomas Hill Easterfield and James Bee	7	1028
15. Note on the supposed permeability of glass. By Alfred Vincent Elsden	7	—

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17. A new dilution law. (Preliminary note.) By James Riddick Partington	8	—
18. 2-Phenyl-1 : 3-benzoxazine-4-one. By Arthur Walsh Titherley	9	200
19. The intramolecular rearrangement of diphenylamine ortho-sulphoxides. Part II. By Edward de Barry Barnett and Samuel Smiles	10	186
20. The effect of contiguous unsaturated groups on optical activity. Part IV. Conjugated systems containing more than two unsaturated groups. By Sydney Robert Edminson and Thomas Percy Hilditch	10	223
21. The alkaloids of the Pukatea. By Bernard Cracroft Aston	11	1381
22. The Friedel-Crafts' reaction applied to naphthalene. Part I. Syntheses with di- and tri-alkyl halides. By Annie Homer	11	1141
23. The Friedel-Crafts' reaction applied to naphthalene. Part II. The action of acetylene tetrachloride and of acetylene tetrabromide. Preparation of $\alpha\beta\alpha'\beta'$-dinaphthanthracene. By Annie Homer	12	

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24. Cupri-compound : citrates, tartrates, acetates. By Spencer U. Pickering	17	1837
25. The constitution of basic salts. By Spencer U. Pickering	19	1851
26. The constituents of red clover flowers. By Frederick Belding Power and Arthur Henry Salway	20	231
27. The influence of radium emanation on equilibrium in a gaseous system. By Francis Lawry Usher	20	389
28. *iso*Quinoline derivatives. Part IV. Ortho-dihydroxy-bases. The conversion of 1-keto-6 : 7-dimethoxy-2-alkyltetrahydro*iso*quinolines into 3 : 4-dihydroxyphenylethylalkylamines. By Frank Lee Pyman	21	264
29. The action of chlorine on phenylcarbamide. By Frederick Daniel Chattaway and Newcomb Kinney Chaney	22	292
30. Halogen derivatives of malonanilide, ethyl malonanilate, and malonanilic acid. By Frederick Daniel Chattaway and Frederick Alfred Mason	22	339
31. A natural substantive dyestuff. By Arthur George Perkin	23	220
32. Reactivity of the halogens in organic compounds. Part IV. Interaction of bromoacetic, α-bromopropionic, and α-bromobutyric acids and their sodium salts with silver salts in aqueous solution. Catalytic action of silver halides. By George Senter	23	346
33. Strychnine, berberine, and allied alkaloids. By William Henry Perkin, jun., and Robert Robinson	24	305

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36. The half-life period of radium ; a correction. By Robert Whytlaw Gray and Sir William Ramsay, K.C.B.	25	185
37. The absorption spectra of dinaphthanthracene and its hexahydro-derivative compared with the absorption spectra of its isomerides. By Annie Homer and John Edward Purvis	25	1155
38. Apparatus for demonstrating the electrolysis of hydrochloric acid. By Augustus Edward Dixon and John Taylor	25	374
39. The relation between reactivity and chemical constitution of certain halogen compounds. By Hans Thacher Clarke	26	416
40. The action of lithium and calcium on organic halides. By James Frederick Spencer and Gwynnedd Mary Price	26	385
41. The change of cobaltous into cobaltic nitrite. By Tsuneo Suzuki	27	726
42. The solubility of potassium sulphate in concentrated aqueous solutions of non-electrolytes. By John Jacob Fox and Arthur Josiah Hoffmeister Gauge	27	377
43. The triazo-group. Part XII. Derivatives of para-triazobenzaldehyde. By Martin Onslow Forster and Hilda Mary Judd	28	254

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45. The influence of colloids and fine suspensions on the solubility of gases in water. Part I. Solubility of carbon dioxide and nitrous oxide. By Alexander Findlay and Henry Jermain Maude Creighton	44	536
46. The absorption spectra of the vapours of pyridine and some of its derivatives at different temperatures and pressures. By John Edward Purvis	45	692
47. Absorption spectra and melting-point curves of aromatic diazoamines. By Clarence Smith and Constance Hamilton Watts	45	562
48. Synthesis of *dl*-narcotine (gnoscopine). Preliminary note. By William Henry Perkin, jun., and Robert Robinson	46	—
49. Isomeric chromous chlorides. By William Arthur Knight and Elizabeth Mary Rich	47	87*
50. The chromous chlorides. By William Arthur Knight	47	

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51. Silver amalgams. By Chapman Jones	47	336
52. Derivatives of *S*-phenylphenazothionium. Part III. By Edward de Barry Barnett and Samuel Smiles	47	362
53. The vapour pressures of two perfectly miscible solids and their solid solutions. By Ernest Vanstone	47	429

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55. The relation between absorption spectra and chemical constitution. Part XIV. The aromatic nitro-compounds and the quinonoid theory. By Edward Charles Cyril Baly, William Bradshaw Tuck, and Effie Gwendoline Marsden	51	571
56. Action of ethyl cyanoacetate on 5-chloro-1 : 1-dimethyl-Δ^4-*cyclo*hexen-3-one. By Arthur William Crossley and Charles Gilling	53	518
57. The constitution of carpaine. Part I. By George Barger	53	466
58. Optically active glycols derived from *l*-benzoin and from methyl *l*-mandelate. By Alex. McKenzie and Henry Wren	54	473
59. The colour and constitution of azo-compounds. Part V. By John Theodore Hewitt and Ferdinand Bernard Thole	54	511
60. The direct union of carbon and hydrogen at high temperatures. Part II. By John Norman Pring	55	498
61. Affinity relations of cupric oxide and of cupric hydroxide. By Arthur John Allmand	55	603
62. 3-Aminoquinoline and the colour of its salts. By William Hobson Mills and Walter Henry Watson	56	741
63. The absorption spectra of *p*-toluidine, *m*-xylidine, and of their condensation products with acetaldehyde. By John Edward Purvis	56	644
64. A supposed case of stereoisomeric tervalent nitrogen compounds. By Humphrey Owen Jones and Edward John White	57	632
65. The isolation of stable salt hydrates, with special reference to the stable hydrates of sodium carbonate. By Alexander Charles Cumming	57	593
63. Salts and ethers of 2 : 3 : 5-trinitro-4-acetylaminophenol. By Raphael Meldola and Harold Kuntzen	58	444
67. The interaction of hydrogen and chlorine. The inhibitive effect of ozone and chlorine dioxide. (Preliminary note.) By David Leonard Chapman and Patrick Sarsfield MacMahon	58	—
68. Diketodiphenylpyrroline and its analogues. Part III. By Siegfried Ruhemann	59	462
69. Triphenyl-2-pyrone. By Siegfried Ruhemann	59	457

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70. The solubility of organic acids and bases in solutions of their salts. (Preliminary note.) By Nevil Vincent Sidgwick	60	—
71. 1 : 4-Dichloroanthraquinone and its derivatives. By Gertrude Maud Walsh and Charles Weizmann	61	685
72. The synthesis of Δ^1-*cyclo*penteneacetic acid and of 1-methyl-Δ^2-*cyclo*hexene-3-acetic acid. By Victor John Harding and Walter Norman Haworth	61	486
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74. Organic derivatives of silicon. Part XIII. Optically active compounds containing one asymmetric silicon group. By Frederick Challenger and Frederic Stanley Kipping	65	755
75. The rate of hydration of acetic anhydride. By Albert Cherbury David Rivett and Nevil Vincent Sidgwick.	66	732
76. The colour and ionisation of cupric salts. By Nevil Vincent Sidgwick and Henry Thomas Tizard	67	957
77. Some new metallic carbonyls. By the late Ludwig Mond, Heinrich Hirtz, and Matthewman Dalton Cowap	67	798
78. Studies of dynamic isomerism. Part X. The relationship between absorption spectra and isomeric change. Absorption spectra of camphorcarboxylic acid and its derivatives. By Thomas Martin Lowry, Cecil Henry Desch, and Herbert William Southgate	68	899
79. Studies of dynamic isomerism. Part XI. The relationship between absorption spectra and isomeric change. Absorption spectra of the acyl derivatives of camphor. By Thomas Martin Lowry and Herbert William Southgate	68	905
80. The action of aromatic amines on ethyl malonate. By Frederick Daniel Chattaway and James Montrose Duncan Olmsted	69	938
81. Synthesis of dipeptides of lauric and *n*-nonoic acids. Products of the condensation of lauric and *n*-nonoic acids with glycine, alanine, and leucine. (Preliminary note.) By Arthur Hopwood and Charles Weizmann	69	—
82. The densities and molecular weights of neon and helium. By Herbert Edmeston Watson	70	810
83. The molecular weights of krypton and xenon. By Herbert Edmeston Watson	70	833
84. Studies in the diphenyl series. Part I. Acetylation of benzidine derivatives. By John Cannell Cain and Percy May	71	720
85. Additive compounds of *s*-trinitrobenzene with arylamines. Combination as affected by the constitution of the arylamine. By John Joseph Sudborough and Stanley Hoskings Beard	71	773

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87. A method for the approximate estimation of small quantities of lead. By A. G. Vernon Harcourt	82	841
88. Komppa's synthesis of camphoric acid. By Gustave Louis Blanc and Jocelyn Field Thorpe	83	836
89. Experiments on the Walden Inversion. Part IV. The interconversion of the optically active phenylmethylglycollic acids. By Alex. McKenzie and George William Clough	85	1016
90. Studies in fermentation. Part III. The rôle of diffusion in fermentation by yeast cells. By Arthur Slator and Henry Julius Salomon Sand	85	922
91. Synthesis of *p*-hydroxyphenylethylalkylamines. By George Stanley Walpole	87	941
92. The condensation of anisaldehyde with resorcinol. By Frank George Pope and Hubert Howard	88	972
93. The influence of persulphates on the estimation of hydrogen peroxide with permanganate. By John Albert Newton Friend	88	—
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96. Some derivatives of tetramethyl ferrocyanide. By Ernald George Justinian Hartley	90	1066
97. The molecular refraction of thiocyanates and other salts. By Augustus Edward Dixon and John Taylor.	90	927
98. Estimation of carbon in iron and steel and in iron alloys by direct combustion. By Thomas Ernest Hull	91	—
99. 2-Methyl-1 : 3-dihydrobenzoxazine-4-one and related derivatives. By William Longton Hicks	91	1032
100. The examination of the atmosphere at various altitudes for oxides of nitrogen and ozone. By Walter Hayhurst and John Norman Pring	92	868
101. Derivatives of *S*-alkylphenazothionium. By Edward de Barry Barnett and Samuel Smiles	92	980
102. Preparation of substituted indoles from benzoin and secondary arylamines. By Marion Brock Richards	92	977
103. The interaction of hydrogen and chlorine. The nature of photochemical inhibition. By David Leonard Chapman and Patrick Sarsfield MacMahon	93	845
104. A new synthesis of thioxanthone and its derivatives. By Eric Gordon Davis and Samuel Smiles. (Preliminary note.)	93	—
105. The action of phosphorus pentachloride on dibenzamide. By Arthur Walsh Titherley and Elizabeth Worrall	93	839
106. Amphoteric metallic hydroxides. Part II. By John Kerfoot Wood	94	878

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107. The action of methyl *tert.*-butyl ketone on ketols. Part I. By Alfred Archibald Boon	94	1256
108. Contributions to our knowledge of oxonium compounds. (Preliminary note.) By Alfred Archibald Boon, Kenneth McKenzie, and John Fountain Reid.	95	—
109. The effect of contiguous unsaturated groups on optical activity. Part V. Physico-chemical evidence of the structure of "α-disulphoxides." By Thomas Percy Hilditch	95	1091
110. The action of phosphorus pentachloride on some unsaturated compounds. By Reginald William Lane Clarke	96	890
111. Experiments on the synthesis of the terpenes. Part X (continued). Synthesis of sylvestrene (*d*-carvestrene). (Preliminary note.) By William Henry Perkin, jun.	97	—
112. Synthesis of cotarnine. (Preliminary note.) By Arthur Henry Salway	98	—
113. Note on the usually-adopted method of calculating additive physico-chemical constants. By Herbert Stanley Redgrove	99	—

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117. The triazo-group. Part XIII. Triazomethylcarbimide (triazomethyl *iso*cyanate). By Martin Onslow Forster and Robert Müller	112	1056
118. The absorption spectra of nicotine, coniine, and quinoline as vapours, liquids, and in solution. By John Edward Purvis	113	1035
119. Fluorones. By Frank George Pope and Hubert Howard	113	1023
120. Ionic equilibrium in solutions of electrolytes. By James Riddick Partington	114	1158
121. Sodium succinates. By Hugh Marshall and David Bain	114	1074
122. The formation and reactions of imino-compounds. Part XII. The formation of imino-derivatives of *cyclo*pentane from open-chain mononitriles. By Alec Duncan Mitchell and Jocelyn Field Thorpe	114	997
123. New sensitive test for hydrocyanic acid. By James Moir	115	—
124. Changes in volume in the formation of dilute solutions. By Harry Medforth Dawson	116	1041
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127. The interaction of alkyl halides and metals of the iron group. By James Frederick Spencer and Muriel Kate Harrison	118	—

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129. The action of potassium chlorate on concentrated sulphuric acid. (Preliminary note.) By Stanley Smith	124	—
130. Mechanism of tautomeric change. By Henry Thomas Tizard	125	—
131. A new sulphide of nitrogen. By Frank Playfair Burt	127	1171
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ADDITIONS TO THE LIBRARY DURING THE YEAR 1910.

Abderhalden, *Emil.* [Editor.] Handbuch der biochemischen Arbeitsmethoden. Vols. II. ii., III. and IV. pp. xxviii + 497 to 1101, 1368 + xxxii, xvi + 699 to 1527. ill. Wien 1910.

Alembic Club Reprints. See **Cannizzaro**, *Stanislao.*

Allen, *Alfred Henry.* Commercial organic analysis. Vols. II. and III. 4th edition. Edited by *Henry* **Leffmann** and *W. A.* **Davis.** pp. x + 520, x + 635. ill. London 1910.

American Electrochemical Society. Transactions. Vols. XII–XVI. Philadelphia 1907–1909. (*Reference.*)

Annett, *Harold Edward.* The nature of the colour of black cotton soil. (From the *Mem. Dept. Agric. India*, 1910, **1.**)

Armstrong, *Edward Frankland.* The simple carbohydrates and glucosides. pp. ix + 112. London 1910.

Armstrong College, Newcastle-upon-Tyne. Reports on dairy investigations at Offerton Hall, County Durham, and in the North of England. pp. 146. Newcastle-upon-Tyne 1909.

Autenrieth, *W.*, and **Koenigsberger**, *J.* Ueber ein neues Kolorimeter und dessen Verwendung zur Bestimmung von Blutfarbstoff, Eisen, Indikan und Kreatinin. (From the *Münch. med. Woch.*, 1910.)

Baker, *Richard T.*, and **Smith**, *Henry G.* A research on the pines of Australia. pp. xiv + 458. ill. Sydney 1910.

Barnet Book of Photography. 9th edition. pp. 316. ill. Barnet 1907.

Basadonna, *Mario.* See **Duparc**, *Louis.*

Bauer, *Max.* Edelsteinkunde. Eine allgemein verständliche Darstellung der Eigenschaften, des Vorkommens und der Verwendung der Edelsteine, nebst einer Anleitung zur Bestimmung derselben, für Mineralogen, Edelsteinliebhaber, Steinschleifer, Juweliere. 2nd edition. pp. xvi + 766. ill. Leipzig 1909.

Beck, *Karl*, **Löwe**, ——, and **Stegmüller**, ——. Zur Kenntnis der bleihaltigen Glasuren und deren Bleiabgabe an saure Flussigkeiten. (From the *Arbeiten. K. Gesundheitsamte*, 1910, **33.**)

Beckurts, *H.*, and **Lüning**, *O.* Die Methoden der Massanalyse. Part I. pp. vii + 482. ill. Braunschweig 1910.

Bedford, *Duke of.* See **Woburn Experimental Fruit Farm.**

Bell, *Sir William J.* The Sale of Food and Drugs Acts, 1875 to 1907. With Notes and Cases; Together with an appendix containing the other acts relating to adulteration, chemical notes, etc. 5th edition. By *Charles F.* **Lloyd.** The chemical notes revised and enlarged by *R. A.* **Robinson.** pp. xl + 303 + 43. London 1910.

Bertoni, *Giacomo.* See **Körner**, *Wilhelm.*

Beythien, *A.* Die Nahrungsmittelverfälschung, ihre Erkennung und Bekämpfung. (Sammlung, Vol. XVI.) Stuttgart 1910.

Blacher, *C.* Feuerungstechnisches. pp. iv + 104 + 7. Riga 1909.

Blum, *L.* Ueber den Abbau von Fettsäuren im Organismus und über die gegenseitigen Beziehungen der Azetonkörper. (From the *Münchener med. Woch.*, 1910.)

Boerhaave, *Hermann.* A new method of chemistry. 2nd edition. Translated by *Peter* **Shaw.** [Vol. I.] pp. xxx + 594. London 1741. (*Reference.*)

Böhm, *C. Richard.* Die Fabrikation der Glühkörper für Gasglühlicht. pp. xiii + 454. ill. Halle a.S. 1910.

Böhringer, *Christian.* See **Körner**, *Wilhelm.*

Bontoux, *Émile.* See **Lewkowitsch**, *Julius.*

Bradley, *W. P.*, and **Hale**, *C. F.* The nozzle expansion of air at high pressure. (From the *Physical Review*, 1909, **29**.)

Bredig, *Georg*, and **Kerb**, *J. W.* Über die elektrische Reizschwelle katalytischer Pulsationen. (From the *Verh. Naturhist. Med. Vereins Heidelberg*, 1909, **10**.)

Breinl, *Anton*, and **Nierenstein**, *M.* Bio-chemical and therapeutical studies on trypanosomiasis. (From the *Ann. Trop. Med. Par.*, 1909, **3**.)

Bruce, *W.* Report on cattle-feeding experiments. (*Bull. Edinburgh and East of Scotland Coll. Agric.*, No. 21, 1910.)

Bruni, *G.* See **Körner**, *Wilhelm.*

Buchner, *Georg.* Die Metallfärbung und deren Ausführung mit besonderer Berücksichtigung der chemischen Metallfärbung. 4th edition. pp. xvi + 397. Berlin 1910.

Buckingham, *Edgar.* On the definition of the ideal gas. (From the *Bull. Bur. Standards*, 1909, **6**.)

—— The theory of the Hampson liquefier. (From the *Bull. Bur. Standards*, 1909, **6**.)

Bünz, *R.* See **Gutbier**, *A.*

Burgess, *George K.* The estimation of the temperature of copper by optical pyrometers. (From the *Bull. Bureau of Standards*, 1909, **6**.)

Burgess, *George K.* See **Waidner**, *C. W.*

Burian, *Richard*, and **Drucker**, *Karl.* Gefrierpunktsmessungen an kleinen Flüssigkeitsmengen. (From the *Zentr. Physiol.*, 1910, **23**.)

Cameron, *Alexander Thomas.* Radiochemistry. pp. viii + 174. ill. London 1910.

Cannizzaro, *Stanislao.* La Scienza e la Scuola. (From the *Rassegna Contemporanea*, 1910, **3**.)

—— Sketch of a course of chemical philosophy. (Alembic Club Reprints, No. 18). pp. iii + 55. Edinburgh 1910.

Clacher, *William.* The use of the refractometer in the analysis of jams and jellies, marmalades and confections. (From the *Int. Sugar J.*, 1910.)

Comessatti, *Giuseppe.* L'azione dello jodio e dei suoi composti sull' adrenalina. (From the *Arch. Farmacol. sper. Sci. affini*, 1909, **8**).

Contardi, *Angelo.* See **Körner**, *Wilhelm.*

Crété, *L.* See **Goris**, *A.*

Crookes, *Sir William.* Diamonds. pp. xvi + 146. ill London 1909.

Dale, *H. H.*, and **Laidlaw**, *P. P.* The action of an active principle from apocynum. (From *Heart*, 1909, **1**.)

Dalton, *Leonard V.* On the origin of petroleum. (From *Economic Geology*, 1909, **4**.)

Damianovich, *Horacio.* Estudio físico-químico y bio-química de las materias colorantes orgánicas artificiales. pp. xvi + 526. Buenos Aires 1909.

Dammer, *Otto.* [Editor.] Chemische Technologie der Neuzeit. Parts I.–VI. ill. Stuttgart 1910.

David, *A. J.* See **Dyer**, *Bernard.*

Davis, *William Alfred.* See **Allen**, *Alfred Henry.*

Desch, *Cecil H.* Metallography. pp. xi + 429. ill. London 1910.

Dittrich, *Max*, and **Leonhard**, *A.* Ueber Eisenoxydulbestimmungen in Silicaten. (From the *Ber. Vers. Oberrheinisch. Geol. Ver.*, 1910, **43**.)

Dixon, *W. E.*, and **Halliburton**, *W. D.* The action of the choroid plexuses on the secretion of cerebro-spinal fluid. (From the *Proc. physiol. Soc.*, 1910; *J. Physiol.*, **40**.)

Drucker, *Karl.* See **Burian**, *Richard.*

—— See **Ostwald**, *W.*

Duboux, *Marcel.* See **Dutoit**, *Paul.*

Duhem, *Pierre.* Thermodynamique et chimie. 2nd edition. pp. xii + 579. ill. Paris 1910.

Duparc, *Louis*, and **Basadonna**, *Mario.* Manuel théorique et pratique d'analyse volumétrique. pp. iv + 170. ill. Genève 1910.

Dutoit, *Paul*, and **Duboux**, *Marcel*. Dosage physico-chimique des cendres du vin. (From the *J. Suisse Chim. Pharm.*, 1909, **47**.)

Dyer, *Bernard*. Fertilisers and feeding stuffs. Their properties and uses. With the full text of the Fertilisers and Feeding Stuffs Act, 1906, the regulations and forms of the Board of Agriculture, and notes on the Act by *A. J.* **David**. 6th edition. pp. viii + 152. London 1910.

Elsden, *James Vincent*. Principles of chemical geology. A review of the application of the equilibrium theory to geological problems. pp. viii + 222. ill. London 1910.

Emde, *Hermann*. Extraktion grosser Mengen spezifisch schwerer Flüssigkeiten mit geringen Mengen spezifisch leichter Lösungsmittel. (From the *Apoth. Zeit.*, 1909, **24**.)

Euler, *Hans*. Allgemeine Chemie der Enzyme. pp. viii + 241. Wiesbaden 1910.

Ewins, *A. J.* Some colour reactions of adrenine and allied bases. (From the *J. Physiol.*, 1910, **40**.)

Fagan, *Thomas Wallace*. See **Lauder**, *Alexander*.

Felsen, *Fedor*. Der Indigo und seine Konkurrenten. Eine kritische Zusammenstellung. pp. 75. ill. Berlin 1909.

Fenton, *Henry John Horstman*. Outlines of chemistry. With practical work. Part I. 2nd edition. pp. xviii + 415. Cambridge 1910.

Flavitzky, *F.* Application des lois d'eutéxie aux produits de fusion eutéctiques des silicates. (From the *Nat. Phil. Soc. Imp. Univ. Kazan*, 1909.)

Fluteaux, *G.* See **Goris**, *A.*

Fourcroy, *Antoine François de*. Systême des connaissances chimiques, et de leurs applications aux phénomènes de la nature et de l'art. 11 vols. Paris, Brumaire An IX. [1801]. (*Reference.*)

Friend, *J. Newton*. An introduction to the chemistry of paints. pp. x + 204. ill. London 1910.

—— The action of steam on iron. (From the *J. W. Scotland Iron and Steel Inst.*, 1910.)

Gildemeister, *Eduard*, and **Hoffmann**, *Friedrich*. See **Rechenberg**, *C. von*.

Gissing, *Charles E.* Spark spectra of the metals. pp. vii + 21. ill. London 1910.

Glaister, *John*. Poisoning by arseniuretted hydrogen or hydrogen arsenide. Its properties, sources, relations to scientific and industrial operations, symptoms, post-mortem appearances, treatment, and prevention. pp. ix + 279. ill. Edinburgh 1908.

Goldschmidt, *F.* See **Ubbelohde**, *L.*

Goris, *A.*, and **Crété**, *L.* Sur la nupharine. (From the *Bull. Sci. Pharm.*, 1910, **17**.)

Goris, *A.*, and **Fluteaux**, *G* Analyse d'une Scammonée naturelle. (From the *Bull. Sci. Pharm.*, 1910, **17**.)

Gortner, *Ross Aiken.* On some new quinazoline derivatives. pp. 49. Easton, Pa. 1909.

Granger, *Albert.* Fabrication et emploi des matériaux et produits réfractaires utilisés dans l'industrie. pp. iv + 378. ill. Paris 1910.

Grimmer, *W.* Chemie und Physiologie der Milch. pp. xii + 364. ill. Berlin 1910.

Groth, *Paul Heinrich.* Chemische Krystallographie. Teil III. Aliphatische und hydroaromatische Kohlenstoffverbindungen. pp. iv + 804. ill. Leipzig 1910.

Gutbier, *A.*, and **Bünz**, *R.* Zur Kenntnis der Wismutperoxyde. (From the *Sitzungsber. Physik.-Med. Soz. Erlangen*, 1908, **40**.)

Haas, *Paul.* Laboratory notes on organic chemistry for medical students. pp. viii + 128. ill. London 1910.

Hämäläinen, *Juho.* Ueber isomere Borneolglykuronsäuren. (From the *Skand. Arch. Physiol.*, 1909, **23**.)

—— Zur Spaltbarkeit der Borneol- und Camphoglykuronsäuren durch Enzyme. (From the *Skand. Arch. Physiol.*, 1910, **23**.)

Haensel, *Heinrich.* Bericht. April–September 1909. pp. 74. Pirna.

Hale, *C. F.* See **Bradley**, *W. P.*

Hall, *William T.* See **Treadwell**, *F. P.*

Halliburton, *William Dobinson.* See **Dixon**, *W. E.*

Hamburger, *H. J.* Osmotischer Druck und Ionenlehre in den medicinischen Wissenschaften. Zugleich Lehrbuch physikalisch-chemischer Methoden. 3 vols. pp. xiii + 539, x + 516, xiii + 508. ill. Wiesbaden 1902–1904.

Hammarsten, *Olof.* Lehrbuch der physiologischen Chemie. pp. viii + 948. Wiesbaden 1910.

Hellsten, *A. F.* Der Einfluss des Trainierens auf die CO_2–Abgabe bei isometrischer Muskelarbeit. (From the *Skand. Archiv. Physiol.*, 1909, **22**.)

Herz, *W.* Der Verteilungssatz. Mit einer Zusammenstellung der wichtigsten Verteilungskoeffizienten zwischen flüssigen Schichten. (Sammlung, Vol. XV.) Stuttgart 1909.

Herzog, *Alois.* Die Unterscheidung der natürlichen und künstlichen Seiden. pp. 78. ill. Dresden 1910.

Herzog, *R. O.* See **Oppenheimer**, *Carl.*

Hewlett, *R. Tanner*, **Villar**, *Sidney*, and **Revis**, *Cecil.* On the nature of the cellular elements present in milk. (From the *J. Hygiene*, 1909, **9**.)

Heyl, *Georg*. Ueber die Alkaloide von Corydalis solida Sm. (From the *Apoth. Zeit.*, 1910, **25**.)

—— Ueber Corydalis aurea. (From the *Apoth. Zeit.*, 1910, **25**.)

Hilgard, *E. W.* Soils: their formation, properties, composition, and relations to climate and plant growth. pp. xxvii + 593. ill. New York 1910 [Reprint of 1906 edition].

Hintz, *E.* Ueber den Arsengehalt der Maxquelle zu Bad Dürkheim a.d. Haardt. (From the *Zeitsch. Balneol.*, 1910, **3**.)

Holleman, *Arnold Frederik*. A text-book of organic chemistry. Edited by *A. Jamieson* **Walker**, assisted by *Owen E.* **Mott**. 3rd English edition. pp. xx + 599. ill. New York 1910.

——— Die direkte Einführung von Substituenten in den Benzolkern. Ein Beitrag zur Lösung des Substitutionsproblems in aromatischen Verbindungen. pp. vi + 516. Leipzig 1910.

Holsti, *Östen*. Zur Kenntnis des Phosphorumsatzes beim Menschen. (From the *Skand. Arch. Physiol.*, 1909, **23**.)

Hooper, *David*. The composition of Indian rice. (From the *Agric. Ledger*, 1908–09.)

—— Tamarisk manna. (From the *J. and Proc. Asiatic Soc. Bengal*, 1909, N.S. **5**.)

—— The secretion of *Phromnia marginella*, Olivier. (From the *J. and Proc. Asiatic Soc. Bengal*, 1909, N.S. **5**.)

Howard, *Albert*, and **Howard**, *Gabrielle L. C.* Wheat in India. Its production, varieties and improvement. pp. ix + 288. ill. Calcutta 1909.

Hüttinger, *K.* See **Kremann**, *R.*

Huggins, *Sir William*. The Royal Society; or, science in the State and in the schools. pp. xv + 131. ill. London [1906].

Imperial Institute. Selected Reports from the Scientific and Technical Department. II. Gums and Resins. III. Foodstuffs. pp. 136 to 203, 200 to 267. London 1909, 1910.

Indian Association for the Cultivation of Science. Report for the year 1908. pp. 65. Calcutta 1909.

Ingle, *Herbert*. Cattle-feeding experiments in Britain. A review of over 200 trials made in the years 1833–1908. (From the *Trans. Highland. Agric. Soc. Scotland*, 1909–1910.)

—— Sheep-feeding experiments in Britain. A review of over 190 trials made in the years 1844–1909. (From the *Trans. Highland. Agric. Soc. Scotland*, 1910.)

Institute of Chemistry of Great Britain and Ireland. Proceedings, 1877–1895. 19 vols. London.

Institute of Chemistry of Great Britain and Ireland. A list of official chemical appointments compiled, . . . by *Richard B.* **Pilcher.** 3rd edition. pp. 234. London 1910.

Institute of Metals. Journal. Vol. II. 1909. Edited by *G. Shaw* **Scott.** pp. viii + 342. ill. London 1909. (*Reference.*)

Jacobsen, *Paul.* See **Meyer,** *Victor.*

Jänecke, *Ernst.* Legierungen. pp. 100. ill. Hannover 1910.

Johannesburg. *Government Laboratories.* Report 1908–09. pp. 16. Pretoria 1910.

Jones, *Llewellyn,* and **Scard,** *Frederic J.* The manufacture of cane sugar. pp. xix + 454. ill. London 1909.

Kayser, *H.* Handbuch der Spectroscopie. Vol. V. pp. vi + 853. ill. Leipzig 1910.

Kerb, *J. W.* See **Bredig,** *Georg.*

Kerp, *W.*, and **Wöhler,** *P.* Zur Kenntnis der gebundenen schwefligen Säuren. IV und V Abhandlung. (From the *Arb. Kais. Gesundheitsamte,* 1909, **32.**)

Klee, *W.* See **Rupp,** *E.*

Königl. Technischen Hochschule zu München. Die neuen chemischen Institute. pp. 64. ill. München 1909.

Koenigsberger, *J.* See **Autenrieth,** *W.*

Körner, *Wilhelm.* L'Opera Classica di Guglielmo Koerner. La determinazione del luogo chimico nei composti cosi detti aromatici. (Pubblicazioni di G. Koerner raccolte ed ordinate in occasione del 50° Anniversario della sua Laurea.) pp. 274. Milano 1910.

—— Ueber die Bestimmung des chemischen Ortes bei den aromatischen Substanzen. Translated and edited by *G.* **Bruni** and *B. L.* **Vanzetti.** (Ostwald's *Klassiker,* No. 174.) Leipzig 1910.

—— Sulla costituzione dell' acido veratrico e del veratrol. (From the *Rend. R. Ist. Lombardo,* 1876, [2], **9.**)

—— Intorno ad alcuni prodotti di trasformazione della chinolina. (From the *Rend. R. Ist. Lombardo,* 1881, [2], **14.**)

—— Intorno all' acido caffeico ottenuto dalla *Cincona Cuprea.* (From the *Rend. R. Ist. Lombardo,* 1882, [2], **15.**)

—— Richerche sulla composizione e costitutuzione della siringina, un glicoside della *Syringa Vulgaris.* (From the *Rend. R. Ist. Lombardo,* 1888, [2], **21.**)

Körner, *Wilhelm,* and **Bertoni,** *Giacomo.* Sintesi di due nuovi acidi isomeri al vanillico. (From the *Rend. R. Ist. Lombardo,* 1884, [2], **13.**)

Körner, *Wilhelm,* and **Böhringer,** *Christian.* Intorno agli alcaloidi della corteccia di angustura. (From the *Rend. R. Ist. Lombardo,* 1883, [2], **16.**)

Körner, *Wilhelm*, and **Contardi**, *Angelo*. Alcuni derivati nitro-alogenati della benzina, dell' anilina e dell' acetanilide. (From the *Annuario Soc. Chim. Milano*, 1908, **14**.)

Körner, *Wilhelm*, and **Menozzi**, *Angelo*. Trasformazione dell' acido aspartico in acido fumarico. (From the *Rend. R. Ist. Lombardo*, 1880, [2], **13**.)

—— —— Eliminazione dell' azoto dalla tirosina. (From the *Rend. R. Ist. Lombardo*, 1881, [2], **14**.)

—— —— Intorno all' azione del joduro metilico sulla leucina ed altre sostanze analoghe. (From the *Rend. R. Ist. Lombardo*, 1883, [2], **16**.)

—— —— Intorno ad un nuovo acido isomero all' aspartico. (From the *Rend. R. Ist. Lombardo*, 1885, [2], **19**.)

—— —— Trasformazione degli acidi fumarico e maleico in acido aspartico e in asparagina. (From the *Rend. R. Ist. Lombardo*, 1887, [2], **20**.)

Körner, *Wilhelm*, and **Wender**, *V*. Intorno ad alcuni nuovi derivati di sostituzione della benzina. (From the *Rend. R. Ist. Lombardo*, 1886, [2], **19**.)

Kremann, *R*. Uber die Fortexistenz von Doppelsalzen, im besonderen von Karnallit und Schönit in wässeriger Lösung. (From the *Jahrb. K. K. Geol. Reichsanstalt*, 1908, **58**.)

—— Beiträge zur Kenntnis isomorpher Mischungen. (From the *Jahrb. K. K. Geol. Reichsanstalt*, 1908, **58**.)

Kremann, *R*., and **Hüttinger**, *K*. Über die Löslichkeit von Aluminiumhydroxyd in Aluminiumsulfatlösungen und zur künstlichen Darstellung von Alumian. (From the *Jahrb. K. K. Geol. Reichsanstalt*, 1908, **58**).

Krogh, *August*, and **Krogh**, *Marie*. The mechanism of gas-exchange. I–VII. (From the *Skand. Arch. Physiol.*, 1910, **23**.)

Krüss, *Gerhard*, und **Krüss**, *Hugo*. Kolorimetrie und quantitative Spektralanalyse in ihrer Anwendung in der Chemie. 2nd edition. pp. xii + 284. ill. Hamburg und Leipzig 1909.

Laidlaw, *P. P*. The active principle of a Bini spear poison. (From the *J. Physiol.*, 1909, **39**.)

—— See **Dale**, *H. H*.

Lauder, *Alexander*, and **Fagan**, *T. W*. The variation in the composition of milk. Fourth annual report on the work at Rosslynlee, 1908–09. pp. 38. Edinburgh 1909.

Leather, *J. Walter*. Water requirements of crops in India. (From the *Mem. Dept. Agric. India*, 1910, **1**.)

Leathes, *John Beresford*. The fats. pp. ix + 138. London 1910.

Leffmann, *Henry*. See **Allen**, *Alfred Henry*.

Lehmann, *F.* Ueber den einfachsten Modus der Zuckerbestimmung in Harn. (From the *Apoth. Zeit.*, 1910, **25**.)

Lenormand, *C.* Détermination du degré de pollution des eaux de mer par le dosage des matières organiques. (From the *Bull. Soc. Pharm.*, 1909, **16**.)

Leonhard, *A.* See **Dittrich**, *Max.*

Lewkowitsch, *Julius.* Technologie et analyse chimiques des huiles, graisses et cires. Traduit . . . par *Émile* **Bontoux**. Vol. III. pp. xi + 1425 to 1973. ill. Paris 1910.

Liljestrand, *G.* Zur Kenntnis der Einwirkung einiger Salze auf die motorischen Nervenstämme des Frosches. (From the *Skand. Archiv. Physiol.*, 1909, **22**.)

Lister Institute of Preventive Medicine. Collected papers, No. 6. London 1909–10.

Lloyd, *Charles F.* See **Bell**, *Sir William J.*

Lodge, *Sir Oliver.* The ether of space. pp. xvi + 156. ill. London 1909.

Löwe, —. See **Beck**, *Karl.*

Lomonossow, *M. W.* Physikalisch-chemische Abhandlungen, 1741–1752. Edited by *B. N.* **Menschutkin** and *Max* **Speter**. (Ostwald's *Klassiker*, No. 178.) Leipzig 1910.

Lowe, *Houston.* Paints for steel structures. pp. 115. New York 1910.

Lüning, *O.* See **Beckurts**, *H.*

Lunge, *Ernest.* Compulsory working and revocation of patents. pp. vii + 89. London 1910.

Lunge, *George.* Coal-tar and ammonia. 4th edition. 2 vols. pp. xix + 563, xiii + 564 to 1178. ill. London 1909.

Luther, *R.* See **Ostwald**, *W.*

Luzzatto, *R.*, and **Satta**, *G.* Intorno al comportamento nell' organismo animale dei Jodoso-Jodil e Jodonio-composti. (From the *Arch. Farm. sperim. Sci.*, 1909, **8**, 1910, **9**.)

Mackenzie, *J. Ross.* Brewing and malting waters. pp. 23. Worcester 1909.

Mannheim, *E.* Toxikologische Chemie. pp. 150. ill. Leipzig 1909.

Martindale, *William Harrison.* Organic analysis chart. pp. 80. London 1910.

Martindale, *William Harrison*, and **Westcott**, *W. Wynn.* The extra pharmacopœia. 14th edition. pp. xxvii + 1054. London 1910.

Mayerhofer, *Ernst.* Einiges zur Esbachschen quantitativen Eiweissbestimmung und über eine neue Kreatininverbindung. (From the *Wien. Klin. Woch.*, 1909, **22**.)

Menge, *George A.* A study of melting-point determinations. (*Bull. U.S. Hygienic Laboratory*, 1910, No. 70.)

Menozzi, *Angelo.* See **Körner**, *Wilhelm.*

Menschutkin, *B. N.* See **Lomonossow**, *M. W.*

Meyer, *J. de.* Allgemeine Bemerkungen über die glykolytischen Prozesse unter Bezugnahme auf die Arbeiten der Herren Stoklasa, Oppenheimer und Rosenberg. (From the *Zentr. Physiol.*, 1910, **23**.)

Meyer, *Julius.* Die Allotropie der chemischen Elemente. (Sammlung, Vol. XV.) Stuttgart 1910.

—— Bemerkungen über die Fermente der Milch. (From the *Arbeiten aus dem Kaiserl. Gesundheitsamte*, 1910, **34**.)

Meyer, *Victor*, and **Jacobson**, *Paul.* Lehrbuch der organischen Chemie. 2nd edition. Vol. I. ii. 2. pp. 289 to 800. Leipzig 1910.

Michaelis, *Leonor.* Dynamik der Oberflächen. pp. iv + 88. Dresden 1909.

Mingaye, *J. C. H.* Notes from the Chemical Laboratory. No. 2. (From the *Records Geol. Sur. N. S. Wales*, 1909, **8**.)

Moir, *James.* Genetic connexions between the chemical elements. (From the *S. African J. Sci.*, 1910.)

Molinari, *Ettore.* Trattato di chimica inorganica. pp. xvii + 924. ill. 3rd edition. Milano 1910.

Mollison, *J.* Report on the progress of agriculture in India for 1907–09. pp. 80. Calcutta 1909.

Moore, *F. J.* Outlines of organic chemistry. pp. ix + 315. New York 1910.

Motolese, *Francesco.* Sulle proprietà farmacologiche dell'acido picrico. (From the *Arch. Farm. sperim*, 1910, **9**.)

Mott, *Owen E.* See **Hollemann**, *A. F.*

Moureu, *Ch.* Notions fondamentales de chimie organique. 3rd edition. pp. iv + 354. Paris 1910.

Neuberg, *Carl.* Verhalten von racemischer Asparaginsäure bei der Fäulnis. (From the *Archiv. Fisiol.*, 1909, **7**.)

—— Zur Frage der Pigmentbildung. (From the *Zeitsch. Krebsforschung*, 1909, **8**.)

New Zealand Department of Agriculture. *Chemistry division* Report, 1909. Wellington 1909.

Nierenstein, *M.* Chemie der Gerbstoffe. (Sammlung, Vol. XV.) Stuttgart 1910.

—— See **Breinl**, *Anton.*

Oesterle, *O. A.*, and **Riat**, *G.* Zur Kenntnis des Aloins. (From the *Schweiz. Woch. Chem. Pharm.*, 1909.)

Oppenheimer, *Carl.* Die Fermente und ihre Wirkungen. Allgemeiner Teil. Nebst einem Sonderkapitel : Physikalische Chemie der Fermente und Fermentwirkungen von *R. O.* **Herzog**. pp. xv + 282. Leipzig 1910.

Orthey, *Max.* Die Metallhüttenchemie. pp. xiv + 532. ill. Leipzig 1910.

Ostwald, *W.*, and **Luther,** *R.* Hand- und Hülfsbuch zur Ausführung physiko-chemischer Messungen. 3rd edition. Edited by *R.* **Luther** and *K.* **Drucker**. pp. xvi + 573. ill. Leipzig 1910.

Ostwald's Klassiker. See **Körner,** *W.*, and **Lomonossow,** *M. W.*

Passon, *Max.* Kleines Handwörterbuch der Agrikulturchemie. 2 vols. pp. iv + 454, 415. ill. Leipzig 1910.

Patta, *Aldo.* Contributo allo studio della supposta azione ricostituente dei fosfati, dei glicero fosfati, delle lecitine sopratutto in condizioni di esaurimento e di depressione del sistema nervoso e del ricambio. pp. 83. Pavia 1909.

——— Osservazioni intorno al comportamento degli ipofosfiti nell' organismo. (From the *Arch. Farm. sperim.*, 1910, **8**.)

Pelet-Jolivet, *L.* Die Theorie des Färbeprozesses. pp. vii + 224. ill. Dresden 1910.

Perkin, *Frederick Mollwo.* Qualitative chemical analysis. 3rd edition. pp. xii + 337. ill. London 1910.

Philip, *James Charles.* Physical chemistry. Its bearing on biology and medicine. pp. vii + 312. ill. London 1910.

Pilcher, *Richard B.* See **Institute of Chemistry of Great Britain and Ireland**

Plimmer, *Robert Henry Aders.* Practical physiological chemistry. pp. viii + 270. ill. London 1910.

Plotnikow, *Joh.* Photochemie. pp. viii + 182. ill. Halle a.S. 1910.

Polenske, *Eduard.* Beitrag zur Fettbestimmung in Nahrungsmitteln. (From the *Arbeiten. K. Gesundheitsamte*, 1910, **33**.)

Rancken, *Dodo.* Ueber die Einwirkung der Massage auf den Eiweissumsatz im Organismus. (From the *Skand. Arch. Physiol.*, 1910, **23**.)

Ray, *Praphulla Chandra.* A history of Hindu chemistry from the earliest times to the middle of the sixteenth century A.D. Vol. II. pp. a–q. + xcvi + 293 + 152 + xxi. Calcutta 1909.

Rechenberg, *C. von.* Theorie der Gewinnung und Trennung der Aetherischen Oele durch Destillation. pp. xii + 259 to 751. [Supplement to **Gildemeister,** *E.*, and **Hoffmann,** *Fr.*, "Die aetherischen Oele."] Leipzig 1910.

Reis, *Robert.* Phytochemische Untersuchung der Erythraea Centaurium Pers. pp. 46. Strassburg 1909.

Revis, *Cecil.* See **Hewlett,** *R. Tanner.*

Riat, *G.* See **Oesterle**, *O. A.*

Richter, *Max Moritz.* Lexikon der Kohlenstoff-Verbindungen. Lieferung I–X. 3rd edition. Hamburg 1910. (*Reference.*)

Robinson, *R. A.* See **Bell**, *Sir William J.*

Royal Medical and Chirurgical Society. The climates and baths of Great Britain. Vol. II. pp. xvi + 628. Maps. London 1902.

Royal Society of Arts. Directory. Edited by *Sir Henry Trueman* **Wood**. pp. 76. London 1909.

Royal Society of London. See **Huggins**, *Sir William.*

Runne, *Ernst.* Titration von Alkaloidsalzen. (From the *Apoth. Zeit.*, 1909, **24**; 1910, **25**.)

Rupe, *Hans.* Anleitung zum experimentieren in der Vorlesung über organische Chemie. pp. x + 130. ill. Braunschweig 1909.

Rupp, *E.*, and **Klee,** *W.* Ueber die Darstellung von Sublimat aus Quecksilbersulfat und Kochsalz auf nassem Wege. (From the *Apoth. Zeit.*, 1910, **25**.)

Rusconi, *Arnaldo.* Sulla ricerca dell'agrostemma nelle farine alimentari e nel pane col metodo dell' emolisi. (From the *Boll. Soc. Med.-Chir. Pavia*, 1910.)

—— L'emolisi come mezzo analitico per la ricerca delle saponine nella birra, nelle acque gazose, e nei vini. (From the *Boll. Soc. Med.-Chir. Pavia*, 1910.)

Sadtler, *Samuel S.* See **Allen,** *Alfred Henry.*

Santesson, *C. G.* Ueber die Einwirkung von Giften auf einen enzymatischen Prozess. (From the *Skand. Arch. Physiol.*, 1909, **23**.)

—— Ueber die Wirkung von Kaliumbromat. (From the *Arch. Fisiol.*, 1909, **7**.)

Satta, *G.* See **Luzzatto,** *R.*

Scard, *Frederic J.* See **Jones,** *Llewellyn.*

Scherer, *Hermann.* Ueber Phytosterine und einige fette Oele. pp. 63. Mülhausen i. E. 1909.

Schimmel & Co. Bericht, Oktober 1909. pp. 236. Leipzig.

Schwalbe, *Carl G.* Die Chemie der Cellulose. Part I. pp. 272. Berlin 1910.

Scott, *G. Shaw.* See **Institute of Metals.**

Senier, *Alfred.* Two Academic Addresses: A visit to Giessen, and Bonn on the Rhine. 2nd edition. pp. 45. Dublin 1910.

—— The University and technical training. pp. 29. Dublin 1910.

Serono, *Cesare.* Metodo per la preparazione dei Metalli colloidali stabili. (From the *Arch. Farm. sperim.*, 1910, **9**.)

Sexton, *A. Humboldt.* Fuel and refractory materials. pp. x + 364. ill. London 1909.

Shaw, *Peter.* See **Boerhaave**, *Hermann.*

Sidgwick, *Nevil Vincent.* The organic chemistry of nitrogen. pp. xi + 415. Oxford 1910.

Siegrist, *H.* De la constitution de quelques dérivés iodés. (From the *J. Suisse Chim. Pharm.*, 1910, **48**.)

Smiles, *Samuel.* The relations between chemical constitution and some physical properties. pp. xiv + 583. ill. London 1910.

Smith, *Henry G.* See **Baker**, *Richard T.*

Speter, *Max.* Lavoisier und seine Vorläufer. Eine historisch-kritische Studie. (Sammlung, Vol. XV.) Stuttgart 1910.

—— See **Lomonossow**, *M. W.*

Stegmüller, —. See **Beck**, *Karl.*

Stewart, *Alfred Walter.* Recent advances in physical and inorganic chemistry. pp. xiv + 267. London 1909.

Stewart, *J. G.* Report on experiments with potatoes, 1909. pp. 12. Edinburgh 1910.

Studzinski, *J.* Ueber die giftigen Eigenschaften des Blutes. (From the *Zentr. Physiol.*, 1910, **23**.)

Széki, *Tibor.* Ueber einige anormale Eigenschaften des Asarylaldehyds. (From the *Naturw. Museumsheften*, 1909, **4**.)

Tassilly, *E.* L'essence d' Ylang-Ylang de la Réunion. (From the *Bull. Sci. Pharm.*, 1910, **17**.)

Taylor, *Robert Llewellyn*, and **Wolfenden**, *J. H.* The student's chemistry. 5th edition. pp. xii + 379. ill. Manchester [1910].

Thibaut, *P*[*ierre*]. The art of chymistry: As it is now practised. Written in French by *P.* **Thibaut**, Chymist to the French King. And now translated into English, by a Fellow of the Royal Society [W.A.]. pp. xxx + 279. London 1668. (*Reference.*)

Thompson, *C. J. S.* The compendium of medicine and pharmacy. 3rd edition. pp. vi + 336. London [1910].

Thomson, *J. J.* The corpuscular theory of matter. pp. vii + 172. ill. London 1907.

Thomson, *Thomas.* A system of chemistry. 5th edition. 4 vols. pp. xii + 567 [wanting v—viii], viii + 700, vii + 618, viii + 684. London 1817.

Thunberg, *Torsten.* Studien über die Beeinflussung des Gasaustausches des überlebenden Froschmuskels durch verschiedene Stoffe. (From the *Skand. Archiv. Physiol.*, 1909, **22**, **23**.)

—— Ueber katalytische Beschleunigung der Sauerstoffaufnahme der Muskelsubstanz. (From the *Zentr. Physiol.*, 1910, **23**.)

Tibbals, *Charles Austin.* A study of tellurides. (From the *Bull. Univ. Wisconsin, Sci. Ser.*, 1909, **3**.)

Tilden, *Sir William A.* The elements. Speculations as to their nature and origin. pp. xi + 139. ill. London 1910.

Treadwell, *Frederick Pearson.* Analytical chemistry. Volume II. Quantitative analysis. Authorised translation from the German by *William T.* **Hall.** 2nd edition. pp. x + 787. ill. New York 1910.

Tutton, *Alfred Edwin Howard.* Crystalline structure and chemical constitution. pp. viii + 204. ill. London 1910.

Tuveri, *S.* Sull' azione del torio sul cuore normale ed in degenerazione grassa. (From the *Arch. Farm. sper. Sci. affini.* 1909, **8.**)

Ubbelohde, *L.*, and **Goldschmidt,** *F.* Handbuch der Chemie und Technologie der Oele und Fette. Vol. 3, part 1. pp. xx + 380. ill. Leipzig 1910.

Vanzetti *B. L.* See **Körner,** *Wilhelm.*

Veley, *Victor Herbert,* and **Veley,** *Lilian J.* The micro-organism of faulty rum. pp. vii + 64. ill. London 1898.

Villar, *Sidney.* See **Hewlett,** *R. Tanner.*

Villavecchia, *Vittorio.* Dizionario di merceologia e di chimica applicata. 3rd edition. Vol. I, A–M. pp. xv + [779]. Milano 1910. (*Reference.*)

Waidner, *C. W.*, and **Burgess,** *G. K.* Platinum resistance thermometry at high temperatures. (From the *Bull. Bureau of Standards,* 1909, **6.**)

—— —— Note on the temperature scale between 100° and 500° C. (From the *Bull. Bureau of Standards,* 1910, **7.**)

Walden, *P.* Die Lösungstheorien in ihrer geschichtlichen Aufeinanderfolge. (Sammlung, Vol. XV.) Stuttgart 1910.

Walker, *A. Jamieson.* See **Hollemann,** *A. F.*

Wallach, *Otto.* Festschrift Otto Wallach zur Erinnerung an seine Forschungen auf dem Gebiete der Terpene in den Jahren 1884–1909, überreicht von seinen Schülern. pp. iv + 684. Göttingen 1909.

Walpole, *George Stanley.* A method of titrating physiological fluids. (From the *Proc. Physiol. Soc.*, 1910 ; *J. Physiol.*, **40.**)

Walter, *E.* Ueber die Verwendung des Benzidins für den Blutnachweis, im besonderen über seine Anwendungsweise in der gerichtsärztlichen Praxis. (From the *Deut. Med. Woch.*, 1910.)

Walter, *L. H.* The metal tungsten as "valve" electrode. (From the *J. Proc. Inst. Elect. Eng.*, 1909, **43.**)

Watson, *Richard.* Institutionum chemicarum in Prælectionibus Academicis explicatarum, Pars Metallurgica. pp. [viii] + 58. Cantabrigiæ 1768. (*Reference.*)

Wedel, *Georg Wolffgang.* Specimen experimenti chimici novi, de sale volatili plantarum, quo demonstratur. Francofurti 1672. (*Reference.*)

Wender, *V.* See **Körner,** *Wilhelm.*

Westcott, *W. Wynn.* See **Martindale,** *William Harrison.*

Wieland, *Heinrich.* Die Knallsäure. (Sammlung, Vol. XV.) Stuttgart 1909.

Wielen, *P. Van der.* Dosage de la morphine, de la narcotine et de la codéine dans l'opium et dans les préparations galéniques de l'opium. (From the *Bull. Sci. Pharm.*, 1910, **17**.)

Woburn Experimental Fruit Farm. Eleventh and twelfth reports. By the **Duke of Bedford** and *Spencer U.* **Pickering.** pp. v + 191 + [xxii], iv + 51. London 1910.

Wöhler, *P.* See **Kerp,** *W.*

Woker, *Gertrud.* Die Katalyse. Die Rolle der Katalyse in der analytischen Chemie. I. Allgemeiner Teil. (Die chemische Analyse, Vol. XI and XII.) Stuttgart 1910.

Wolfenden, *J. H.* See **Taylor,** *Robert Llewellyn.*

Wolff, *Jules.* Contribution a la connaissance de divers phénomènes oxydasiques naturels et artificiels. pp. ii + 93. Laval 1910.

Wood, *Sir Henry Trueman.* See **Royal Society of Arts.**

Zanoni, *G.* Sintesi della β-metilpiridina (β-picolina). (From the *Rend. R. Ist. Lombardo*, 1881, [2], **14**.)

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PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 365.

Thursday, January 20th, 1910, at 8.30 p.m., Professor Harold B. Dixon, F.R.S., President, in the Chair.

The President referred to the loss sustained by the Society in the death of Mr. Edmund Alfred Pontifex (elected on December 4th, 1848), which took place on November 12th, 1909.

It was announced also by the President that the Council desired to invite Past President Professor William Odling, who was elected a Fellow of the Society early in 1848, to the dinner at which it was proposed to entertain the Past Presidents who have completed fifty years of Fellowship. Professor Odling was one of the Past Presidents whose Jubilee was celebrated in 1898.

Messrs. A. C. G. Egerton, H. R. Ellis, W. C. McC. Lewis, and R. V. Norris were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Herbert Arthur Berens, Sidney Sussex College, Cambridge.
Arthur James Child, Oaklands, Edgware.
Reginald Henry Cocks, M.A., 14, Norbiton Avenue, Kingston Hill, Surrey.
Leonard Harry Cooper, 524, Fulham Palace Road, Fulham, S.W.
Bernard Okes Coventry, 24, Bolingbroke Grove, Wandsworth Common, S.W.
Benjamin Leslie Emslie, Glengairn, Oakville, Ontario.
John Handley, P.O. Box 247, New Liskeard, Ontario.

Walter Hayhurst, B.Sc., Tremellen Street, Accrington.
Leslie Charles W. Jenkins, 31, Eastcombe Avenue, Charlton, Kent.
Hans Krall, B.A., Trinity College, Dublin.
John Herbert Lavender, 27, Parade Street, Barrow-in-Furness.
Alexander Marcan, Royal Mint, Bangkok, Siam.
George Williams Neal, B.Sc., 8, Little Park Gardens, Enfield.
Philip Brady Nicholson, 2, Silverwood Terrace, Thrybergh, Rotherham.
Gilbert Palmer, B.Sc., 17, Wansbeck Gardens, West Hartlepool.
Clifford Clare Rattey, 37, Park Avenue, Swinton, near Manchester.
John Russell, B.A., "Oaklands," Carsick Hill, Tom Lane, Sheffield.
Aswini Kumar Sen, B.A., B.Sc., 81/82, Harrison Road, Calcutta.
Ernest William Smith, 20, St. Bevan's Road, Halifax.
Murray Stuart, B.Sc., 27, Chowringhee, Calcutta.
Percy George Ward, B.Sc., The Lodge, Preston Park, Brighton.
John Young, Highfield, Stanley Road, Teddington.

Certificates have been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Messrs.:

Eduard Buchner, Ph.D., Burgstrasse 8, Breslau I.
Malur Srinivasa Rau, M.A., M.D., B.Sc., Bangalore, India.

Of the following papers, those marked * were read :

*1. "The alkaloids of ergot. Part II."

By George Barger and Arthur James Ewins.

Ergotoxine (Barger and Carr, *Trans.*, 1907, **91**, 337) has now been shown to possess a carboxyl group; ergotinine, its anhydride, is probably a lactone. When ergotinine is warmed with a dilute solution of phosphoric acid in absolute alcohol, the crystalline *phosphate* of *ergotoxine ethyl ester*, $C_{34}H_{40}O_4N_5 \cdot CO_2Et, H_3PO_4$, is formed. This new base is amorphous; it differs from ergotoxine in being insoluble in dilute sodium hydroxide, and in yielding a series of salts having a different crystalline form from that of the corresponding ergotoxine salts.

It is probable that the ester is also formed to some extent when ergotinine and ergotoxine are heated with alcohol in the absence of acids. The fall of optical rotation of alcoholic ergotinine solutions has been examined.

On destructive distillation, both of ergotinine and of ergotoxine, a small quantity of a crystalline sublimate is formed, which has been identified as *iso*butyrylformamide, $CHMe_2 \cdot CO \cdot CO \cdot NH_2$; a new synthesis of this substance was described.

*2. "The constituents of colocynth."

By Frederick Belding Power and Charles Watson Moore.

The material employed in this investigation was Turkish colocynth, consisting of the dried, peeled fruit of *Citrullus Colocynthis*, Schrader. The pulp of the fruit represented 24·4 per cent. of the whole. An alcoholic extract of the pulp, on distillation with steam, yielded a small amount of an essential oil. From the portion of the extract which was soluble in water there were isolated a new dihydric alcohol, $C_{22}H_{36}O_2(OH)_2$ (m. p. 285—290°), designated as *citrullol*, and an amorphous, alkaloidal principle, which possesses strongly purgative properties. The aqueous liquid contained, furthermore, a quantity of inorganic material, a little sugar, and a very small amount of an amorphous, glucosidic substance. The portion of the alcoholic extract which was insoluble in water consisted chiefly of resinous material, but from it there were isolated a considerable quantity of α-elaterin (m. p. 232°; $[\alpha]_D$ $-68·9°$); small amounts of hentriacontane, $C_{31}H_{64}$, and a phytosterol, $C_{27}H_{46}O$ (m. p. 160—162°, optically inactive); a mixture of fatty acids, and a little of the above-mentioned alkaloidal principle. None of the constituents of the resin were glucosidic, but the portions extracted by ether and chloroform possessed purgative properties. No evidence could be obtained of the presence of β-elaterin.

The seeds of the colocynth, which represented 75·5 per cent. of the entire peeled fruit, contained traces of an alkaloidal principle, a small amount of an enzyme, and yielded 12·72 per cent. of fatty oil. From the latter there was isolated a small amount of a phytosterol, $C_{20}H_{34}O$ (m. p. 158—160°; $[\alpha]_D$ $+8·1°$).

The results of the present investigation have led to the conclusion that the so-called "colocynthin" and "colocynthitin," which have previously been recorded as constituents of colocynth, consisted of mixtures of a very indefinite character.

*3. "Organic derivatives of silicon. Part XII. Dibenzylethylpropylsilicane and sulphonic acids derived from it." By Frederick Challenger and Frederic Stanley Kipping.

With the object of obtaining an optically active compound containing only one asymmetric silicon atom, the authors have prepared *dibenzylethylpropylsilicane*, $SiEtPr(CH_2Ph)_2$, by the interaction of benzylethylpropylsilicyl chloride and magnesium benzyl chloride; and also more conveniently, by the interaction of dibenzylethylsilicyl chloride and magnesium propyl bromide. It is a colourless liquid, boiling at 262—265°/90 mm. The dl-*monosulphonic acid*,

$$CH_2Ph{\cdot}SiEtPr{\cdot}CH_2{\cdot}C_6H_4{\cdot}SO_3H,$$

is produced together with a *disulphonic acid*, probably

$$SiEtPr(CH_2{\cdot}C_6H_4{\cdot}SO_3H)_2,$$

when the silicohydrocarbon is treated with chlorosulphonic acid in chloroform solution. The separation of these acids is accomplished with the aid of their strychnine or *l*-menthylamine salts.

The resolution of the *dl*-monosulphonic acid has been effected, and the details will be communicated later.

*4. "Formation of heterocyclic compounds. Part II. Action of bases on the *aa*′-dibromo-derivatives of certain dicarboxylic acids." By Henry Rondel Le Sueur and Paul Haas.

cis-Tetrahydrofuran-2 : 5-dicarboxylic acid and muconic acid are formed by the interaction of alcoholic potassium hydroxide and *aa*′-dibromoadipic acid, m. p. 192—193°. Ethyl 1-phenylpyrrolidine-2 : 5-dicarboxylate is the main product formed on heating together diethylaniline and ethyl *aa*′-dibromoadipate; ethyl muconate is also formed in small amount, and during the course of the reaction a considerable quantity of ethyl bromide is evolved.

The action of aniline and of ethylaniline on ethyl *aa*′-dibromosuccinate and of aniline on ethyl *aa*′-dibromosebaçate has been investigated, but in these cases no cyclic compound analogous to those mentioned above is produced.

5. "The triazo-group. Part XI. Substituted triazomalonic and phenyltriazoacetic acids." By Martin Onslow Forster and Robert Müller.

With the purpose of observing further the effect of environment on the behaviour of the triazo-group, the properties of substituted triazomalonic acids have been studied.

Methyltriazomalonic, *ethyltriazomalonic*, and *phenyltriazomalonic acids* with their *esters* and *amides* have been prepared, and also the *ethyl* ester and *amide* of *bistriazomalonic acid*, and the substances subjected to comparison with the corresponding derivatives of triazoacetic and *phenyltriazoacetic* acids.

6. "Iodobenzenemonosulphonic acids. Part II. Esters and salts of di- and tri-iodobenzenesulphonic acids." By Mary Boyle.

Ethyl and *methyl* esters of 2 : 5-, 3 : 5-, 2 : 4-, and 3 : 4-*di-iodobenzenesulphonic*, and of 3 : 4 : 5-, 2 : 4 : 5-, and 2 : 3 : 5-*tri-iodobenzene-*

sulphonic acids have been prepared and studied. The accumulation of iodine in the nucleus considerably reduces the stability of the sulphonic ester, the tri-iodo-derivatives being readily hydrolysed by water and by alcohol.

The *sodium*, *potassium*, and *ammonium* salts of 2 : 4- and 3 : 5-di-iodo- and of 3 : 4 : 5-, 2 : 4 : 5-, and 2 : 3 : 5-tri-iodobenzenesulphonic acids have been prepared and investigated with regard to water of crystallisation and to solubility. Experiments on the electrical conductivities of the acids have also been carried out, the results of which, however, will be communicated later.

7. "The absorption spectra of naphthalene and of tetramethylnaphthalene." By Annie Homer and John Edward Purvis.

The absorption curves for both *N*/1000- and *N*/10-solutions of the hydrocarbon, $C_{14}H_{16}$ (*Trans.*, 1908, **93**, 1319), are similar to the curves for naphthalene. They confirm the previous suggestion that the hydrocarbon is a tetramethylnaphthalene.

The observations of Baly and Tuck (*Trans.*, 1908, **93**, 1902) with regard to the presence of bands corresponding with $1/\lambda$ 3125 and $1/\lambda$ 3220 in naphthalene and its derivative are confirmed.

Hartley represented the naphthalene curve for dilute solutions as being characterised by four narrow bands. Baly and Tuck consider that their broad band $1/\lambda$ 3700 corresponds with Hartley's four bands. The curves obtained by the present authors for *N*/1000-solutions of naphthalene and of its tetramethyl derivative show four narrow bands, and these observations support Hartley's first interpretation.

8. "The influence of various substituents on the optical activity of tartramide. Part III. Halogen-substituted anilides." By Percy Faraday Frankland and Douglas Frank Twiss.

In continuation of the work of one of the authors on the connexion between chemical constitution and optical activity, and more especially on the effect on rotatory power exercised by substituting hydrogen in the amido-groups of tartramide (see *Trans.*, 1903, **83**, 1342, 1349; 1906, **89**, 1852), the preparation and properties of the three chloro- and three bromo-anilides of tartaric acid were described. The *m*-iodo-anilide, which will be more fully described later, has also been compared as regards its rotation with the other halogen-anilides. The relation between the optical activity of these compounds and that of tartranilide and of the tartarotoluidides was discussed.

9. "The action of water of crystallisation on calcium carbide." By Irvine Masson.

It was shown that on mixing excess of powdered calcium carbide with powdered crystalline hydrates, generation of acetylene takes place with great velocity, in some cases at laboratory temperature, in others at higher temperatures. The volume of gas can, after standardisation, be used as a measure of the amount of dehydration.

Of twenty-two hydrated salts examined, many are rendered anhydrous, whilst others form stable lower hydrates, some of which have not previously been recorded.

When ammonium salts are dehydrated with calcium carbide, it is found that in most cases no ammonia is liberated, even at 160°, and in spite of the presence of calcium hydroxide. Crystalline acids and acid salts do not react as acids on the carbide or hydroxide.

10. "Decomposition of dimercurammonium nitrite by heat." By Prafulla Chandra Rây and A. C. Ghosh.

When its temperature is slowly raised to 250°, dimercurammonium nitrite, NHg_2NO_2, decomposes, with the production of mercury, oxygen, nitrogen, and nitrous oxide. The volume of the nitrogen is about twice that of the nitrous oxide. The oxygen is quite small in quantity, but never wanting. Nitric oxide is entirely absent, except when the salt has been rapidly heated. The principal decomposition, expressed by the equation: $NHg_2NO_2 = N_2 + 2HgO$, resembles that of ammonium nitrite into nitrogen and water. The equation $NHg_2NO_2 = N_2O + Hg + HgO$ represents another mode of decomposition.

11. "The adsorption of uranium-X by barium sulphate." By Arthur John Berry.

Determinations of the adsorption of uranium-X by barium sulphate have been made by precipitating the barium sulphate in solutions of uranyl nitrate in radioactive equilibrium, measurements being made of the β-ray activity of the precipitate. It has been found that the quantity $\frac{\log (a-x)}{\log x/m}$ is a constant, where a is the initial amount of uranium-X, x the amount adsorbed, and m the mass of barium sulphate adsorbing it. The value of the constant depends on various conditions, chiefly on the dilution and on the amount of sulphuric acid. Other things being equal, dilution and excess of sulphuric acid favour adsorption.

12. "Experiments on the Walden inversion. Part III. Optically active β-hydroxy-β-phenylpropionic acids and the corresponding β-bromo-β-phenylpropionic acids." By Alex. McKenzie and Herbert Brooke Perren Humphries.

The resolution of inactive β-hydroxy-β-phenylpropionic acid into its optically active components was described. The displacement of the hydroxy-group in these acids by bromine has been studied, and also the displacement of bromine by the hydroxy-group in the corresponding active bromo-acids.

13. "The double nitrites of mercury and the metals of the alkaline earths." By Prafulla Chandra Rây.

The author has used the general method of preparation of the double nitrites of mercury and the alkali metals (*Trans.*, 1907, **91**, 2031) in order to obtain similar double nitrites of mercury and the alkaline earths.

The following salts were described: *mercuric calcium nitrite*, $Hg(NO_2)_2,Ca(NO_2)_2,5H_2O$; *mercuric strontium nitrite*,

$$3Hg(NO_2)_2,2Sr(NO_2)_2,5H_2O,$$

and *mercuric barium nitrite*, $3Hg(NO_2)_2,2Ba(NO_2)_2,5H_2O$.

14. "The resin acids of the Coniferae. Part II. Matai-resinol." By Thomas Hill Easterfield and James Bee.

The heart resin of the "Matai" tree (*Podocarpus spicatus*) consists chiefly of a crystalline substance, $C_{19}H_{20}O_6$, isomeric with the pinoresinol obtained by M. Bamberger from the exudation-resin of *Pinus laricio* and *Picea vulgaris*. Both compounds contain two methoxy- and two hydroxy-groups. *Matairesinol* is a lactone; it melts at 119°, and has $[\alpha]_D$ $-4{\cdot}89°$. The *lactonic acid*, *disulphonic acid*, and *acetyl* and *benzoyl* derivatives were described.

15. "Note on the supposed permeability of glass." By Alfred Vincent Elsden.

C. Zengelis (*Zeitsch. physikal. Chem.*, 1909, **65**, 341) describes experiments in which the vapours of various substances appeared to pass through glass at the ordinary temperature. In one of his experiments, silver foil was placed on the outside of a sealed flask containing iodine, the whole being placed in an air-tight vessel. The silver showed distinct signs of attack in three days. Zengelis considers that there was a real loss of weight in Landolt's experiments, due to the loss of vapours through the glass walls of the containing vessels. On the other hand, Landolt himself has drawn a contrary conclusion.

Since, according to Zengelis, iodine vapour can pass through glass with such readiness, it should be possible to detect a progressive loss of weight of a sealed glass vessel containing iodine. In order to test this, some iodine was placed in a small-thin walled glass tube of about 2 mm. diameter, formed by drawing out a test-tube, the tube being then sealed up in the blowpipe flame. It was cleaned and placed in a box containing silver leaf to absorb any iodine vapour which might pass through the glass. This tube was carefully weighed from time to time during nine months, but no loss of weight could be detected.

The weights observed were :

Gram :	0·15331	0·15330	0·15329	0·15332	0·15332	0·15332	0·15333	0·15332	0·15331
Date :	20/3/09	22/3/09	28/3/09	19/4/09	1/8/09	2/8/09	29/8/09	4/9/09	20/12/09

In another experiment, a sealed glass tube containing iodine was sealed within a larger glass tube containing silver leaf. At the end of nine months the silver leaf showed no signs of attack. Since these experiments were started, A. Stock and H. Heynemann (*Ber.*, 1909, **42**, 1800) have published the result of a similar experiment, but have not confirmed Zengelis' observations, which are probably the result of imperfect sealing or the presence of minute cracks and bubbles in the glass.

16. "3 : 5-Dichloro-*o*-phthalic acid."

By Arthur William Crossley and Gertrude Holland Wren.

3 : 5-Dichloro-*o*-phthalic acid has been synthesised from 3 : 5-dinitro-*o*-xylene as a starting point, and its properties have been compared with those of the acid obtained by Crossley and Le Sueur (*Trans.*, 1902, **81**, 1533) from the product of the action of phosphorus pentachloride on dimethyldihydroresorcin, with the result that the two acids have been proved identical (compare Villiger, *Ber.*, 1909, **42**, 3529).

17. "A new dilution law." (Preliminary note.)

By James Riddick Partington.

Ostwald's dilution formula, $a^2/(1-a)v = constant$, assumes that ionisation is spontaneous in the same sense as the thermal dissociation of a gas. In the ionisation of a gas by Röntgen rays, etc., the rapidly moving ion exerts great influence on the ionisation of molecules in its path. Larmor has made a passing suggestion that a similar influence may be exerted by ions in solutions of electrolytes. This leads to the equation : $a^2/(v + Ka)(1 - a) = constant$, K being a new constant. This is found to be in quantitative agreement with the data for potassium, lithium, sodium and ammonium chlorides, lithium, sodium and silver nitrates, and potassium iodide, all of which show marked deviations from Ostwald's formula. The following examples illustrate this :

(1) Potassium chloride in aqueous solution at 18°.

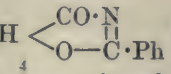
K =	0·018	0·015	0·016	0·017	0·016
K^1 =	0 0239	0·0235	0·0337	0·0652	0·1025

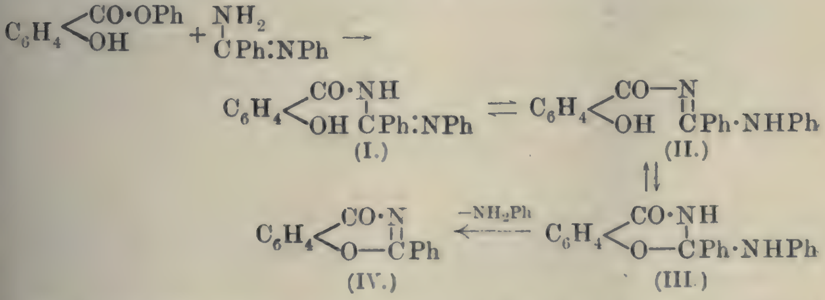
K = constant calculated by the new formula, K^1 is that calculated by Ostwald's formula.

(2) Silver nitrate in aqueous solution at 18°.

K =	0·0062	0·0059	0·0061	0·0068
K^1 =	0·0089	0·0088	0·0115	0·0216

18. "2-Phenyl-1 : 3-benzoxazine-4-one."
By Arthur Walsh Titherley.

The unsaturated cyclic compound  $C_6H_4<\begin{matrix}CO\cdot N\\ \ \ \ \ \ \ \ \ \ \ \|\\ O—C\cdot Ph\end{matrix}$ (2-*phenyl*-1 : 3-*benzoxazine*-4-*one*) has been synthesised from phenyl salicylate and phenylbenzamidine. At 110° phenol is eliminated, forming the tautomeric compound *salicylphenylbenzamidine* (I and II), which by reversible decomposition yields aniline and the cyclic compound (IV), probably through the intermediate third tautomeric form (III) :

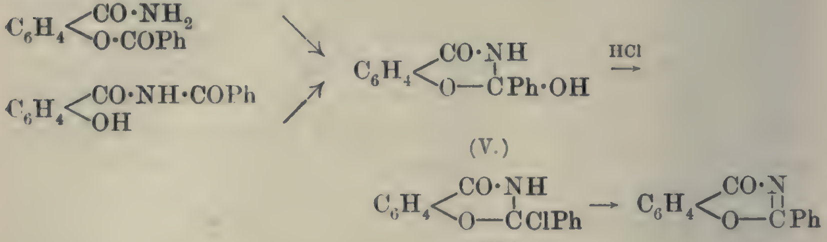


$$C_6H_4<\begin{matrix}CO\cdot OPh\\ OH\end{matrix} + \begin{matrix}NH_2\\ |\\ CPh{:}NPh\end{matrix} \longrightarrow$$

$$\underset{\text{(I.)}}{C_6H_4<\begin{matrix}CO\cdot NH\\ \quad\ \ |\\ OH\ \ CPh{:}NPh\end{matrix}} \rightleftharpoons \underset{\text{(II.)}}{C_6H_4<\begin{matrix}CO—N\\ \quad\ \ \|\\ OH\ \ CPh\cdot NHPh\end{matrix}}$$

$$\underset{\text{(IV.)}}{C_6H_4<\begin{matrix}CO\cdot N\\ \quad\ \ \|\\ O—CPh\end{matrix}} \xleftarrow{-NH_2Ph} \underset{\text{(III.)}}{C_6H_4<\begin{matrix}CO\cdot NH\\ \quad\ \ |\\ O—CPh\cdot NHPh\end{matrix}}$$

The same unsaturated cyclic compound (IV) has also been obtained by the catalytic action of hydrogen chloride on *O*- and *N*-benzoylsalicylamides between 110° and 140 by removing the water as it is produced. The unstable 2-hydroxy- and 2-chloro-dihydrobenzoxazone derivatives (V and VI) appear to be formed as intermediate compounds which cannot be isolated.



(V.)

(VI.)

2-Phenyl-1 : 3-benzoxazine-4-one melts at 106°, and possesses marked additive properties. It is comparatively stable towards aqueous alkalis, but is rapidly decomposed in presence of hydrogen ions, combining with water with formation of the *N*-benzoylsalicylamide, through the intermediate compound (V). Aniline is similarly added, yielding the above salicylphenylbenzamidine (I and II) in yellow needles melting at 106°, but the reaction is reversible, and the amidine derivative readily loses aniline on heating, with production of 2-phenyl-1 : 3-benzoxazine-4-one.

19. "The intramolecular rearrangement of diphenylamine ortho-sulphoxides. Part II." By Edward de Barry Barnett and Samuel Smiles.

N-Methyldiphenylamine *o*-sulphoxide is converted into the azothionium salt without loss or rearrangement of the methyl group. Hence with the imino-sulphoxides the reaction does not involve the direct migration of hydrogen from the imino- to the thionyl group. In this reaction the sulphoxide salts are formed as initial products, and it is these substances which are converted into the azothionium derivatives. The process which the sulphoxide salts undergo in the final stage of the reaction cannot be conclusively determined, but the alternative hypotheses: (*a*) elimination of water, or (*b*) migration of hydroxyl, afford a satisfactory explanation of the change.

20. "The effect of contiguous unsaturated groups on optical activity. Part IV. Conjugated systems containing more than two unsaturated groups." By Sydney Robert Edminson and Thomas Percy Hilditch.

The change of rotatory power on successively increasing the number of adjacent unsaturated groups attached to an optically active system has been studied in the cases of phenolic derivatives (of the type of *o*-hydroxybenzylideneacetone, etc.) and naphthyl (2-aceto- and 2-benzo-*a*-naphthol) esters of camphoric and camphor-β-sulphonic acids. An approximation to the normal rotatory power of esters of these acids has been obtained by examination of their ethyl, *n*-propyl, and *n*-butyl derivatives.

Both series of hydrogen camphorates show accompanying increase of molecular rotatory power with increasing number of unsaturated groups, but the camphor-β-sulphonates are less definite.

Combining these results with various data which previous work has rendered it possible to collate, it is found that of eleven available series, four show a progressive increase, four a progressive decrease, and the remaining three indefinite relations to the optical activity of the corresponding compound containing two contiguous unsaturated radicles.

No generalisation is therefore possible, but it is noticeable that practically all these unsaturated compounds possess rotatory powers greater than the normal value of saturated derivatives.

21. "The alkaloids of the Pukatea." By Bernard Cracroft Aston.

The Pukatea (*Laurelia novae Zealandiae*) has been found to contain three alkaloids, namely: *pukateine*, $C_{17}H_{17}O_3N$, which is crystalline, melts at 200°, and has $[\alpha]_D - 220°$; *laureline*, $C_{19}H_{21}O_3N$, which is amorphous, but forms well crystallised salts; and *laurepukine*, $C_{16}H_{18}O_3N$, which is also amorphous.

The physiological action of pukateine (in the form of its hydrochloride) resembles that of strychnine, but is not so intense.

22. "The Friedel-Crafts' reaction applied to naphthalene. Part I. Syntheses with di- and tri-alkyl halides." By Annie Homer.

The Friedel-Crafts' reaction with naphthalene proceeds according to two equations:

$$RH + R_1Cl = RR_1 + HCl \quad (1)$$
$$RH + RH = RR + 2H \quad (2).$$

Both reactions occur simultaneously, but if the reaction is initiated at a high temperature, then the relative velocity of (2) is so much greater than that of (1) that there is a complete preponderance of the products of reaction (2) over those of reaction (1).

The work was confined to the study of the action of ethylidene chloride, methylene chloride, ethylene bromide, and chloroform on naphthalene.

It was found that the reaction proceeded primarily according to reaction (1) in the case of ethylidene chloride, ethylene bromide, and chloroform, although the products finally isolated were those due to secondary reactions taking place. In the case of methylene chloride the only products which could be obtained were those in accordance with reaction (2), as it was not possible to work under conditions favourable to reaction (1).

23. "The Friedel-Crafts' reaction applied to naphthalene. Part II. The action of acetylene tetrachloride and of acetylene tetrabromide. Preparation of $\alpha\beta\alpha'\beta'$-dinaphthanthracene." By Annie Homer.

From among the products of the action of acetylene tetrachloride and acetylene tetrabromide on naphthalene in presence of aluminium chloride there has been isolated a substance melting at 267·5°, and having the formula $C_{22}H_{14}$. This hydrocarbon is identical with a substance obtained by Dewar and Jones by the action of nickel carbonyl on naphthalene (*Trans.*, 1904, **85**, 212), but which had not been investigated by them. The formation of the substance by these two reactions, which in the benzene series yield anthracene derivatives, together with the ease with which the hydrocarbon can be reduced to a hexahydride, point to its being $\alpha\beta\alpha'\beta'$-dinaphthanthracene. The melting point of the compound, its persistent colour, the colour of its sulphuric acid solution, and the melting point of its quinone and picrate all show that it is not the same dinaphthanthracene as that prepared by Hartenstein (*Diss.*, Jena, 1892), which, from the mode of formation, must have the $\beta\beta\beta'\beta'$-configuration.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Abderhalden, *Emil.* [Editor.] Handbuch der biochemischen Arbeitsmethoden. Vols. II. ii., and III. i. pp. xxviii + 497 to 1101, 478. ill. Wien 1910. (*Recd.* 5/1/10.)
From the Publishers: Messrs. Urban and Schwarzenberg.

Blacher, *C.* Feuerungstechnisches. pp. iv + 104 + 7. Riga 1909. (*Recd.* 21/12/9.) From the Publisher: N. Kymmel.

Crookes, *Sir William.* Diamonds. pp. xvi + 146. ill. London 1909. (*Recd.* 11/1/10.) From the Author.

Lewkowitsch, *Julius*. Technologie et analyse chimiques des huiles, graisses et cires. Traduit . . . par *Émile* **Bontoux**. Vol. III. pp. xi + 1425 to 1973. ill. Paris 1910. (*Recd.* 17/1/10.) From the Author.

Stewart, *Alfred Walter*. Recent advances in physical and inorganic chemistry. pp. xiv + 267. London 1909. (*Recd.* 19/1/10).
From the Author.

Woburn Experimental Fruit Farm. Eleventh report. By the **Duke of Bedford** and *Spencer U.* **Pickering**. pp. v + 191 + [xxii]. London 1910. (*Recd.* 10/1/10.) From the Authors.

II. *By Purchase.*

Herz, *W.* Der Verteilungssatz. Mit einer Zusammenstellung der wichtigsten Verteilungskoeffizienten zwischen flüssigen Schichten. (Sammlung, Vol. XV.) Stuttgart 1909.

Wieland, *Heinrich*. Die Knallsäure. (Sammlung, Vol. XV.) Stuttgart 1909.

III. *Pamphlets.*

Dalton, *Leonard V.* On the origin of petroleum. (From *Economic Geology*, 1909, **4**.)

Hooper, *David*. The composition of Indian rice. (From the *Agricultural Ledger*, 1908–09, No. 5.)

Lauder, *Alexander*, and **Fagan**, *T. W.* The variation in the composition of milk. Fourth annual report on the work at Rosslynlee, 1908–09. pp. 38. Edinburgh 1909.

Mackenzie, *J. Ross*. Brewing and malting waters. pp. 23. Worcester 1909.

JULIUS THOMSEN MEMORIAL LECTURE.

The Julius Thomsen Memorial Lecture will be delivered by Professor Sir EDWARD THORPE, C.B., F.R.S., at the Ordinary Scientific Meeting on Thursday, February 17th, 1910, at 8.30 p.m.

PRESENTATION TO PROFESSOR KOERNER.

A Committee has been formed in Milan with the object of celebrating the seventieth birthday of Professor Koerner. It is proposed to devote subscriptions to the following purposes :

1. Foundation of a prize for work in pure and applied chemistry.
2. Reprinting Professor Koerner's works.
3. Presentation of a gold medal to Professor Koerner.

The Treasurer of the Chemical Society will be glad to receive subscriptions, and will forward them to the Organising Committee.

BLOCKS OF DIAGRAMS.

The Council has decided to dispose of all the blocks of diagrams, etc., which have appeared in the Journal or Proceedings prior to the year 1904, and Fellows are notified that these blocks may be had if application be made to the Assistant Secretary before February 28th, 1910. A small charge will be made to cover cost of looking out the blocks, and postage.

At the next Ordinary Scientific Meeting on **Thursday**, February **3rd**, 1910, at **8.30** p.m., the following papers will be communicated:

"Cupric compounds: citrates, tartrates, and acetates." By S. P. U. Pickering.

"The constitution of basic salts." By S. P. U. Pickering.

"The action of chlorine on phenylcarbamide." By F. D. Chattaway and N. K. Chaney.

"Halogen derivatives of malonanilide, ethyl malonanilate, and malonanilic acid." By F. D. Chattaway and F. A. Mason.

"The constituents of red clover flowers." By F. B. Power and A. H. Salway.

"A natural substantive dyestuff." By A. C. Perkin.

"The influence of radium emanation on equilibrium in a gaseous system." By F. L. Usher.

"Reactivity of the halogens in organic compounds. Part IV. Interaction of bromoacetic, α-bromopropionic, and α-bromobutyric acids and their sodium salts with silver salts in aqueous solution. Catalytic action of silver halides." By G. Senter.

"Strychnine, berberine, and allied alkaloids." By W. H. Perkin and R. Robinson.

"*iso*Quinoline derivatives. Part IV. Ortho-dihydroxy-bases. The conversion of 1-keto-6 : 7-dimethoxy-2-alkyltetrahydro*iso*quinolines into 3 : 4-dihydroxyphenylethylalkylamines." By F. L. Pyman.

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[*Issued* 12/2/10.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 366.

Thursday, February 3rd, 1910, at 8.30 p.m., Professor Harold B. Dixon, F.R.S., President, in the Chair.

Messrs. A. J. Ewins and H. T. Tizard were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Herbert Edmund Clarke, B.Sc., 20, Grosvenor Road, Jesmond, Newcastle-on-Tyne.
William Jacob Jones, B.Sc., Queen's Terrace, Llanrwst.
Frederick Charles Lewis, 20, Eskburn Road, Liverpool.
Hubert Leslie Lucking, Ph.D., St. Mary's, West Heath Road, Hampstead, N.W.

Of the following papers, those marked * were read:

*24. "Cupri-compounds: citrates, tartrates, acetates."

By Spencer U. Pickering.

The constitution suggested for the cupric carbonates has been confirmed by a study of the citrates, of which eleven have been isolated or recognised. They are derived from the potassiocupric citrate, $(C_6H_5O_7)_2K_4Cu$, the copper becoming electronegative by union with two carbons, and also quadrivalent. The β-salt contains

$$M^{I}OHOC\cdot Cu^{IV}O\cdot CO_2$$

(in which case it is alkaline), or $Cu^{II}O_2C\cdot Cu^{IV}O\cdot CO_2$, resulting from the union of potassium hydroxide or cupric oxide with the double citrate. More potash converts the $:Cu^{iv}O$ into $:Cu^{iv}OHOK$, the substance becoming violet, oxidising dextrose, and combining with cellulose. This is the γ-salt. The α-salt is produced from the double salt and an alkaline carbonate, the elements of potassiocupric carbonate becoming added to the former. The double salt dissolves to form a β-cupri-salt with $(HO)_2C{\cdot}Cu^{iv}O{\cdot}CO_2$: this obviates having to regard the former as a molecular compound. A similar explanation applies to the acetates.

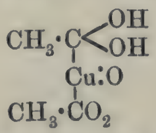
Hydroxides of the alkali metals with copper tartrate first form a neutral β-cupritartrate, containing $(HO)_2C{\cdot}Cu^{iv}O{\cdot}CO_2$, and also a $:Cu^{iv}O$ group between each pair of CHOH groups. Excess of alkali converts these into the $:Cu^{iv}OHOK$ groups of the γ-salt.

All γ-salts decompose, giving cupric or cuprous oxides : a γ-cupridextrose, with a $:Cu^{iv}OHOK$ group between each pair of carbons, would explain the proportion of copper reduced by dextrose.

Discussion.

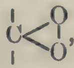
Mr. E. H. **Jeffers** remarked that as regards the citrate known as Luff's salt, no other formula than the one now put forward by Mr. Pickering seemed to him to account for the strongly alkaline nature of that particular compound.

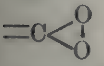
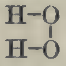
Mr. **Tizard** said he would like to know how copper acetate would ionise if it really had the formula Mr. Pickering suggested, namely :



$$\begin{array}{l} CH_3{\cdot}C{<}^{OH}_{OH} \\ \quad\ \ | \\ \quad\ Cu{:}O \\ \quad\ \ | \\ CH_3{\cdot}CO_2 \end{array}$$

Mr. Pickering had said that solutions of copper acetate differed from those of other copper salts in having a deeper colour, and in depositing copper hydrate at high concentrations. But a deep colour was not an exclusive property of the acetate ; all copper salts of weak acids had a more or less deep colour in solution—the weaker the acid the deeper being the colour. Again, the deposition of hydrate merely meant that hydrolysis of the salt was so great that at high concentrations the solution became supersaturated with regard to the hydrolytic product. He thought there was no reason why the ordinary formula for copper acetate should be given up.

Sir W. **Ramsay** said that three professedly new, but really old, forms of combination had been adduced by Mr. Pickering. First, linked oxygen in  $>C{<}^{O}_{O}|$, that we probably knew in hydrogen dioxide ; secondly, copper as tetrad, that we knew in "real" potassium cuprate, K_2CuO_3, a red substance; and lastly, copper in direct union with carbon, that was known in copper acetylide. The cupritartrates did not display the property of hydrogen dioxide, or of a cuprate, or of copper acetylide.

Mr. Pickering said that in the case of the carbonates it was evident that the only alternative to the copper atom being united to oxygen, as in compounds with electropositive copper, was to leave it united with the carbon. That the cupricarbonates on electrolysis were found to contain an electronegative copper ion had been demonstrated by Wood and Jones, and the same had been proved as regards the cupritartrate by Masson and Steele. No novelty attached to the idea of copper being able to act as a tetrad, being electronegative or being directly united to carbon; but it was quite fallacious to argue that, because this latter form of union obtained in copper acetylide, which was explosive, all compounds exhibiting such a union must be explosive too. There were other reasons, quite apart from the union of the copper and carbon, to account for the explosiveness of copper acetylide. Similarly, it could not be argued that the group  $=C<\begin{array}{l}O\\ |\\ O\end{array}$ would be unstable, because  $\begin{array}{l}H-O\\ \quad\ |\\ H-O\end{array}$ was so; for the latter, in decomposing, formed an exceptionally stable substance, with a large evolution of heat.

The formulæ suggested for the acetates removed the difficulties presented of explaining the differences exhibited between these substances and ordinary copper salts. That suggested for the composition of cupridextrose (the existence of which could not be questioned) agreed exactly with the amount of copper yielded by it, and could not be discredited because it indicated the formation of formaldehyde; for, as a matter of fact, formic acid was, according to Claus, one of the products of its decomposition and oxidation.

*25. "The constitution of basic salts." By Spencer U. Pickering.

Additional evidence of the individuality of the five basic salts formed by the action of lime on copper sulphate was given, and it was shown that whilst the lower members are true basic salts, the higher members contain electronegative copper, and show all the properties of cupri-compounds; they also contain calcium oxide and calcium sulphate. The extreme members of the series are simply cuprates of calcium. A simple scheme was suggested which seems to give a full explanation of the constitution and various properties of the compounds.

Iron appears to form analogous compounds, namely, ferrates, with the metal in the electronegative condition.

*26. "The constituents of red clover flowers."

By Frederick Belding Power and Arthur Henry Salway.

The flowers of the common red clover (*Trifolium pratense*, Linné), which are used to some extent medicinally, have been subjected to a complete chemical examination.

A quantity of the alcoholic extract, representing 37·1 kilograms of the dried flowers, when distilled with steam yielded 10·5 grams, or 0·028 per cent., of essential oil. This essential oil, which contained furfuraldehyde, possessed the following constants: d 20°/20 = 0·9476; $\alpha_D + 4°0'$ in a 1-dcm. tube.

The portion of the alcoholic extract which was soluble in water contained a large amount of sugar, which yielded *d*-phenylglucosazone (m. p. 205°), but from the aqueous liquid the following definite substances were isolated: salicylic and *p*-coumaric acids; *iso*rhamnetin, $C_{16}H_{12}O_7$ (m. p. 295°), which was probably present in the form of a glucoside; a number of new phenolic substances: *pratol*,

$$OH{\cdot}C_{15}H_8O_2{\cdot}O{\cdot}CH_3$$

(m. p. 253°), which apparently is a hydroxymethoxyflavone; *pratensol*, $C_{17}H_9O_2(OH)_3$ (m. p. 210°); a yellow *compound*, $C_{16}H_{10}O_7$ (m. p. 280°); a *substance*, $C_{15}H_7O_3(OH)_3$ (m. p. 225°); a *substance*, $C_{14}H_{12}O_6$ (m. p. 214°); also the following new glucosides: *trifolin*, $C_{22}H_{22}O_{11},H_2O$ (m. p. 260°), which yields on hydrolysis a yellow colouring matter, *trifolitin*, $C_{16}H_{10}O_6$ (m. p. 275°), and rhamnose; iso*trifolin*, $C_{22}H_{22}O_{11}$ (m. p. 250°), and a glucoside of quercitin, melting at 235°.

The portion of the alcoholic extract which was insoluble in water consisted chiefly of resinous material, but from it the following compounds were obtained: myricyl alcohol, $C_{31}H_{63}{\cdot}OH$; heptacosane, $C_{27}H_{56}$, and hentriacontane, $C_{31}H_{64}$; sitosterol, $C_{27}H_{46}O$ (m. p. 135—136°; $[\alpha]_D - 34{\cdot}4°$); a new dihydric alcohol, *trifolianol*, $C_{21}H_{34}O_2(OH)_2$ (m. p. 295°); a mixture of fatty acids, and a small amount of pratol, $C_{16}H_{12}O_4$, the latter having evidently been present in the resin in the form of a glucoside.

*27. "The influence of radium emanation on equilibrium in a gaseous system."

By Francis Lawry Usher.

A quantitative study of the pressure changes following the introduction of radium emanation into ammonia and mixtures of nitrogen and hydrogen, coupled with analysis of the resulting mixture of gases, lead to the following conclusions:

(1) Ammonia is decomposed rapidly at the ordinary temperature, and solid ammonia less rapidly at −190°.

(2) This decomposition is nearly irreversible, and re-combination of nitrogen and hydrogen was not observed to take place to a greater extent than 0·86 per cent.

(3) At the ordinary temperature the decomposition follows approximately the course of a unimolecular homogeneous reaction when correcting factors for the decay of the emanation, and alteration of its efficiency with time, are introduced.

(4) The maximum effect observed was the decomposition of 134,300 molecules of ammonia per atom of emanation. The energy required to produce this effect is about one per cent. of the energy actually expended during its production.

(5) If the ratio of ammonia to emanation molecules does not exceed 10,000 to 1, the statement that each atom in disintegrating produces the same effect is not strictly true, on account of the waste involved when the system is rich in emanation.

(6) All experiments with gases in glass vessels in presence of the emanation are complicated by the fact that gas is driven into the glass, and can only be recovered by heating strongly in a vacuum.

*28. "*iso*Quinoline derivatives. Part IV. Ortho-dihydroxy-bases. The conversion of 1-keto-6 : 7-dimethoxy-2-alkyltetrahydro*iso*quinolines into 3 : 4-dihydroxyphenylethylalkylamines." By Frank Lee Pyman.

A number of ortho-dihydroxy-bases have been prepared by the action of hot concentrated hydrochloric acid under pressure on certain 6 : 7-dimethoxy*iso*quinoline derivatives described in the previous papers of this series. None of those in which the *iso*quinoline ring was preserved had any marked physiological action, but the 1-keto-6 : 7-dimethoxy-2-alkyltetrahydro*iso*quinolines gave rise to 3 : 4-dihydroxyphenylethylalkylamines, bases of very considerable pressor properties.

DISCUSSION.

Dr. HEWITT suggested that the anhydride obtained from dihydroxydihydro*iso*quinoline methiodide by the action of alkalis possibly possessed a quinonoid instead of a phenol-betaine structure. Substances of undoubted phenol-betaine constitution behaved as the phenoxides of powerful bases, dissolving in water to give alkaline solutions (for example, the anhydride of *o*-hydroxyphenyltrimethylammonium hydroxide: Griess, *Ber.*, 1880, **13**, 246).

Further, A. E. Dunstan, J. J. Fox, and J. T. Hewitt had shown that the coloured methiodides of hydroxy- and amino-substituted acridines (hydroxy- or amino-group in the para-position to the meso-carbon atom) yield nearly colourless carbinol bases, which when heated give intensely coloured anhydrides.

Dr. Pyman replied that the compound in question had the characteristic properties of phenol-betaines mentioned by Decker and Dunant (*Annalen*, 1908, **358**, 296); amongst others, that of forming the methoxy-derivative of the *iso*quinolinium iodide when heated with methyl iodide.

29. "The action of chlorine on phenylcarbamide." By Frederick Daniel Chattaway and Newcomb Kinney Chaney.

Since each of the three hydrogen atoms attached to nitrogen in the compound can be exchanged for halogen, which can also pass into the nucleus, the action of chlorine on phenylcarbamide is a complicated one. The isolation of the various *N*-chloro-derivatives is rendered difficult, and in some cases impracticable, by the circumstance that the conditions under which the group $\cdot CO \cdot NHCl$ is stable bring about the transformation of the group $\cdot NCl \cdot C_6H_5$.

Owing to the group $\cdot CO \cdot NHCl$ breaking down with liberation of nitrogen in presence of alkali bicarbonates, chlorination has to be effected in acid solution, and consequently *N*-chloro-derivatives containing the unsubstituted phenyl residue, although undoubtedly formed, have not been isolated in a pure state. An account was given of the preparation and properties of a large number of the theoretically possible *N*-chloro-derivatives of *p*-chloro-, 2 : 4-dichloro-, and 2 : 4 : 6-trichloro-phenylcarbamide.

30. "Halogen derivatives of malonanilide, ethyl malonanilate, and malonanilic acid." By Frederick Daniel Chattaway and Frederick Alfred Mason.

The halogen derivatives of malonanilide and of ethyl malonanilate are produced together when ethyl malonate in some excess is heated for a short time with the corresponding aniline, and can easily be separated owing to the sparing solubility of the anilides in all ordinary solvents.

The halogen substituted malonanilic acids are obtained by hydrolysing the corresponding substituted malonanilic esters. When heated they decompose quantitatively into carbon dioxide and the similarly substituted acetanilides, thus, for example:

$$C_6H_2Cl_3 \cdot NH \cdot CO \cdot CH_2 \cdot CO_2H = CO_2 + C_6H_2Cl_3 \cdot NH \cdot CO \cdot CH_3.$$

The compounds containing chlorine and bromine in the 4-, 2 : 4-, and 2 : 4 : 6-positions were described.

31. "A natural substantive dyestuff." By Arthur George Perkin.

The material known as the "red dura" of the Soudan consists of the leaf sheaths and stem of a variety of the *Andropogon sorghum* or "Great Millet." In dyeing property it closely resembles sanderswood (*Pterocarpus santalinus*), giving with unmordanted wool a dull red shade, but this is rendered more permanent when a chromium or copper mordant is employed. The colouring matter, $C_{16}H_{12}O_5$, which, owing to its similarity to santalin, is called *dura-santalin*, forms a scarlet, crystalline powder, soluble in alkalis with a violet-red coloration. On fusion with alkali it yields phloroglucinol and *p*-hydroxybenzoic acid.

32. "Reactivity of the halogens in organic compounds. Part IV. Interaction of bromoacetic, α-bromopropionic, and α-bromobutyric acids and their sodium salts with silver salts in aqueous solution. Catalytic action of silver halides." By George Senter.

The reactions in question are mainly bimolecular, but are complicated by various disturbing causes. The results of the kinetic experiments with silver nitrate at 26° are summarised in the accompanying table, in which the numbers in the second and fifth lines represent the velocity-coefficients. In order to reduce them to a concentration of one mol. per litre, they must be multiplied by 600.

$CH_2Br\cdot CO_2H$.	$CHMeBr\cdot CO_2H$.	$CHEtBr\cdot CO_2H$.
0·0000055	0·00055	0·0025
[1]	[100]	[450]
$CH_2Br\cdot CO_2Na$.	$CHMeBr\cdot CO_2Na$.	$CHEtBr\cdot CO_2Na$.
0·000016	0·0025	0·0060
[3]	[450]	[1100]

The numbers in brackets give the relative reactivities of the compounds, referred to the slowest as unity.

The silver bromide precipitated in the course of the reactions exerts a powerful accelerating influence on the velocity. Even 1/1000 molar silver bromide (mainly present in the insoluble form) may double the speed of a reaction. Silver iodide exerts a similar catalytic influence on the reaction between silver nitrate and methyl iodide in aqueous solution. These observations appear to account for some hitherto unexplained results obtained by previous observers.

Nitric acid and benzenesulphonic acid greatly retard the rate of reaction between silver nitrate and bromopropionic acid; lactic acid has a much smaller effect. The rate of reaction is not greatly affected by replacing half the solvent water by alcohol and by acetone respectively.

33. “Strychnine, berberine, and allied alkaloids.”

By William Henry Perkin, jun., and Robert Robinson.

The constitution of strychnine and brucine and their derivatives was discussed in detail, and a modification of the usually accepted formula of berberine was suggested.

34. “Δ^1-Nonylenic acid.”

By Victor John Harding and Charles Weizmann.

A description was given of the methods of preparation of Δ^1-nonylenic acid, its derivatives, and means of identification.

35. “The constitution of the amidines. A new method for determining molecular symmetry.” By Julius Berend Cohen and Joseph Marshall.

H. v. Pechmann (*Ber.*, 1895, 28, 869) stated that the amidines obtained (I) from benzanilide imidochloride and *p*-toluidine, and (II) from benzoyl-*p*-toluidide imidochloride and aniline, were identical, and that on ethylation a mixture of two ethyl derivatives was produced, corresponding with the replacement of the H* by C_2H_5 in the two formulæ:

$$\underset{\text{(I.)}}{NPh\!:\!CPh\cdot N\overset{*}{H}\cdot C_7H_7} \qquad\qquad \underset{\text{(II.)}}{C_7H_7\cdot N\!:\!CPh\cdot N\overset{*}{H}Ph.}$$

Where the bases differed in character, however, the amidines obtained by the two methods were still identical, but methylation produced only one methyl derivative, indicating a fixed structure for the original amidine.

The present investigation was undertaken to determine whether the introduction of optically active groups into the amidine would offer a more delicate means of distinguishing between the products of the two reactions in the event of their being indistinguishable by other means. *l*-Menthylamine was used in the earlier experiments as the active base, and the other bases taken were aniline, the three toluidines, and ethylamine. The several amidines were prepared by the two methods, and it was found that they were in each case absolutely identical as regards specific rotation and other physical properties. Furthermore, by ethylation it was shown that the amidines were in no case mixtures, but definite compounds in which the mobile hydrogen atom was attached to the less basic group.

Finally, an amidine was prepared in which the two bases used, namely, *d*- and *l*-bornylamine, were enantiomorphous. In this case it was found that the product was inactive, showing that it is probably a mixture of the two amidines in equal quantities. The ethylation product was also inactive. Attempts to resolve the simple amidine and the ethyl derivative into active constituents by fractional crystallisation of the *d*-camphorsulphonate were unsuccessful.

36. "The half-life period of radium; a correction." By Robert Whytlaw Gray and Sir William Ramsay, K.C.B.

The half-life period of radium deduced from the volume of emanation yielded by 1 gram of the element in radioactive equilibrium was erroneously given as 1258 years (*Trans.*, 1909, **95**, 1082). The correct value of this constant, calculated from the published experimental data, is 1744 years.

37. "The absorption spectra of dinaphthanthracene and its hexahydro-derivative compared with the absorption spectra of its isomerides." By Annie Homer and John Edward Purvis.

The results of this investigation are: (1) the spectroscopic evidence supports the proposition that the hydrocarbon, $C_{22}H_{14}$ (m. p. 267·5°), is a dinaphthanthracene compound, and that its hydride, $C_{22}H_{20}$, no longer contains an anthracene linking.

(2) Hartenstein's substance is not a dihydrodinaphthanthracene, but a dinaphthanthracene isomeric with both the dinaphthanthracene compound (m. p. 267·5°) and picene.

(3) The origin of the differences in the absorption bands of the above four compounds may be explained by a consideration of the differences in the anthracene linkings and in the angular or linear linkings of the rings.

38. "Apparatus for demonstrating the electrolysis of hydrochloric acid." By Augustus Edward Dixon and John Taylor.

The electrolysis is performed in a large, vertical U-tube, into the limbs of which two arc-light carbon rods are plunged.

From near the top of each limb, a short delivery tube passes off horizontally; by means of these tubes the electrolytic gases are led into the measuring vessel, which contains concentrated sulphuric acid. The latter vessel consists of a three-limbed tube of special construction, one of the limbs serving to control the pressure, while the other two receive and measure the hydrogen and the chlorine.

A method was described for staining the sulphuric acid, and thus rendering visible, at a greater distance than usual, the collection of the gases. The construction of the apparatus is such as to preclude leakage of the electrolyte, and to admit of ready access for the purpose of cleaning.

39. "The relation between reactivity and chemical constitution of certain halogen compounds." By Hans Thacher Clarke.

The reactivity towards alcoholic pyridine of the halogens (X) in a series of compounds of the type $X\cdot CH_2\cdot R$ has been studied, the group (R) being varied in each case. It was shown that the reactivity of the halogen is controlled by the residual affinity of the atom or group (R), and a dynamic formula for the carboxyl group was suggested.

40. "The action of lithium and calcium on organic halides." By James Frederick Spencer and Gwynnedd Mary Price.

Calcium and lithium react with organic halides on heating in a manner analogous to that observed in the interaction of magnesium and organic halogen derivatives (*Trans.*, 1908, **93**, 68).

In the case of calcium, the reaction proceeds along two lines, as indicated by the equations:

$$R\cdot X + Ca = R\cdot CaX\ ;\ 2R\cdot X + Ca = CaX_2 + R\cdot R.$$

The compounds $R\cdot CaX$ are decomposed readily by water, giving the parent substances of the original halide:

$$2R\cdot CaX + 2H_2O = 2R\cdot H + CaX_2 + Ca(OH)_2.$$

In ethereal solution, calcium reacts similarly to magnesium in the Grignard reaction. The yield of the products in these reactions rarely exceeds 40 per cent. of the theoretical amount. Lithium reacts much more readily than calcium on organic halides, with the production of lithium substitution products of the parent substance of the original halogen compound:

$$R\cdot X + 2Li = LiX + R\cdot Li.$$

The lithium derivatives are very unstable, and are immediately decomposed by water, yielding the parent substance of the halide used:

$$R\cdot Li + H_2O = R\cdot H + LiOH.$$

A second action takes place along with the formation of the lithium hydrocarbon, namely, the formation of compounds containing twice as many carbon atoms as the halide compound taken:

$$2R\cdot X + 2Li = 2LiX + R\cdot R.$$

The yields obtained in these reactions are generally very good, and vary from 80 per cent. of aniline in the case of *m*-chloroaniline to 8 per cent. of octane from *sec.*-octyl iodide.

41. "The change of cobaltous into cobaltic nitrite."

By Tsuneo Suzuki.

In 1860, dark brownish-red crystals of very basic cobaltic nitrite were obtained by Lang, when he evaporated the solution left on mixing molecular quantities of cobalt sulphate and barium nitrite. Some years later, Hampe found that this crystalline, very soluble substance also contained cobaltous nitrite. It has now been quantitatively investigated. A straw-yellow silver salt and a potassium hydroxycobaltous hydroxycobaltinitrite have also been prepared. The composition of the silver salt is expressed by $Ag_3Co_2'''(NO_2)_6(OH)_3$, from which it follows that a double atom of cobalticum in this salt is combined, half as hydroxide and half as nitrite, with silver nitrite.

Lang's product, very soluble in water and alkaline to litmus, appears to correspond in composition with the silver salt, but to have cobaltous hydroxide and hydroxynitrite combined with the cobaltic hydroxide, thus:

$$3[Co_3''Co_2'''(NO_2)_9(OH)_3,Co''(NO_2)(OH)],2Co''(OH)_2,34H_2O = Co_{14}''Co_6'''(NO_2)_{20}(OH)_{16},34H_2O.$$

Of the change undergone by cobaltous nitrite, the primary product is probably $Co_4''Co_2'''(NO_2)_{10}(OH)_4$, as shown by the following equation:

$$6Co''(NO_2)_2 + 2H_2O = 2NO + 3Co''(NO_2)_2,Co_2'''(NO_2)_3(OH)_3,Co''(NO_2)(OH),$$

which then, by cumulative resolution, yields Lang's crystals and a salt in solution, probably $Co_3''Co_2'''(NO_2)_9(OH)_3$, analogous to the silver salt.

42. "The solubility of potassium sulphate in concentrated aqueous solutions of non-electrolytes." By John Jacob Fox and Arthur Josiah Hoffmeister Gauge.

The solubility of potassium sulphate at 25° in aqueous solutions of ethyl alcohol, ethylene glycol, glycerol, mannitol, sucrose, acetone, pyridine, and chloral hydrate was determined. It was observed that as the number of hydroxyl groups in the molecule of the non-electrolyte was increased, the precipitating effect on the potassium sulphate was decreased. The results were discussed from the point of view of the hydration of the non-electrolyte, and of the possible hydration of the ions derived from potassium sulphate. Jones and Getman's results as to the relative hydration of the non-electrolytes (*Amer. Chem. J.*, 1904, **32**, 308) were shown to be inadequate to account for the depression of solubility in the various solutions.

43. "The triazo-group. Part XII. Derivatives of para-triazobenzaldehyde." By Martin Onslow Forster and Hilda Mary Judd.

In the hope of explaining the peculiar change undergone by the potassium derivative of *p*-hydroxyphenylazoimide when a solution in alcohol or water is boiled, condensation products of *p*-triazobenzaldehyde with hydroxylamine, phenylhydrazine, *p*-aminophenol, and camphoryl-ψ-semicarbazide were studied, and the isomerism of the *p*-triazobenzaldoximes was investigated.

BLOCKS OF DIAGRAMS.

The Council has decided to dispose of all the blocks of diagrams, etc., which have appeared in the Journal or Proceedings prior to the year 1904, and Fellows are notified that they may obtain the blocks illustrating their own papers by applying to the Assistant Secretary before February 28th, 1910. A small charge will be made to cover cost of looking out the blocks, and postage.

At the next Ordinary Scientific Meeting on **Thursday**, February **17**th, 1910, at **8.30** p.m., Sir Edward Thorpe, F.R.S., will deliver the Julius Thomsen Memorial Lecture, and the following papers will be communicated:

"The absorption spectra of the vapours of pyridine and some of its derivatives at different temperatures and pressures." By J. E. Purvis.

"Absorption spectra and melting-point curves of aromatic diazoamines." By C. Smith and C. H. Watts.

"Synthesis of *dl*-narcotine (enoscopine). Preliminary note." By W. H. Perkin, jun., and R. Robinson.

"Isomeric chromous chlorides." By W. A. Knight and Miss E. M. Rich.

"The chromous chlorides." By W. A. Knight.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, February 17th, 1910.

Adams, Percival Frederick,

81, Rock Avenue, Gillingham, Kent.

Lecturer. Inter. B.Sc. (London). Science Lecturer under the Kent Education Committee at the Technical Institute, Gillingham. The chief reason for which admission to the Society is desired is that use may be made of the Society's publications and library.

T. Martin Lowry.	A. N. Fitzgerald.
H. R. Redman.	*H. F. Fermor.*

Sidney Harvey.

Auchinleck, Gilbert Grahame,

Basseterre, St. Kitts, B.W. Indies.

Science Master, St. Kitts-Nevis Grammar School. B.Sc. of McGill University, Montreal, Canada. Science Master, St. Kitts-Nevis Grammar School, from June 1st, 1908, to present date. Subsequently appointed Superintendent of Agriculture to Government of Grenada, W.I.

J. Wallace Walker.	Francis Watts.
H. A. Tempany.	*John R. Bovell.*

E. Gillman.

Banister, Fred,

The Grammar School, Doncaster.

Master at the Doncaster Grammar School. B.Sc. Second Class Honours in Chemistry, University of Wales. Formerly Master at the Grammar School, St. Anne's-on-Sea. Desirous of keeping in touch with the latest developments of Chemistry.

P. G. Mander.	Allan Baguley.
Kennedy J. P. Orton.	*C. R. Young.*
H. O. Jones.	*W. J. Jarrard.*
R. Henry Jones.	*W. E. S. Turner.*

Kenneth S. Caldwell.

Berens, Herbert Arthur,

Sidney Sussex College, Cambridge.

Exhibitioner. Taking Natural Science Tripos (Part II.) in Chemistry in 1911. Taking up Manufacturing Chemistry.

H. O. Jones. A. E. Bellars.
Charles T. Heycock. W. J. Pope.
H. O. Hale.

Canton, Howard,

"Lionsdale," 2, Gloucester Road, Regent's Park, N.W.

Student of Dentistry and Medicine. Student of Chemistry (Inorganic, Organic, and Analytical) for 5 years.

Ernest J. Parry. Hugh Candy.
John C. Umney. *Frank E. Weston.*
Walter Hibbert.

Child, Arthur James,

Oaklands, Edgware.

Student of Chemistry. Studying as B.Sc. Honours Student at University College, London. Have studied 3 years under Sir William Ramsay.

E. de Barry Barnett. N. T. M. Wilsmore.
H. Thacher Clarke. P. May.
Edward C. Cyril Baly. J. Norman Collie.
Samuel Smiles.

Cocks, Reginald Henry,

14, Norbiton Avenue, Kingston Hill, Surrey.

Science Master. Student at Oxford University, 1898–1902. Honours in Chemistry (M.A.). Science Master, Kingston Grammar School, 1903–1909. Lecturer in Chemistry, Kingston-on-Thames Polytechnic, 1909.

W. W. Fisher. N. V. Sidgwick.
T. S. Moore. A. F. Walden.
G. H. J. Adlam.

Cooper, Leonard Harry,

524, Fulham Palace Road, Fulham, S.W.

Analytical Chemist. Assistant to Mr. W. J. Dibdin, F.I.C., F.C.S., etc. Author of the paper: "Colorimetric Estimation of Bromine and Iodine in the presence of Chlorine." This paper will be read at the March meeting of the Society of Public Analysts.

W. J. Dibdin. J. C. Crocker.
J. L. White. J. Lewkowitsch.
J. B. Coleman. *J. Augustus Voelcker.*

Coventry, Bernard Okes,

24, Bolingbroke Grove, Wandsworth Common, S.W.; also Dehra Dun, U.P., India.

Deputy Conservator of Forests and Imperial Forest Chemist, Imperial Forest Service, India. The candidate has been deputed by the Government of India to study Chemistry with the object of qualifying for a post of Forest Chemist in India. Since appointed Imperial Forest Chemist from October 24th, 1909.

Harold Hartley. N. V. Sidgwick.
D. H. Nagel. Allan F. Walden.
R. W. Sindall.

Cumming, Alexander Charles,

39, Viewforth, Edinburgh.

Lecturer and Assistant in Chemistry in the University of Edinburgh. D.Sc. (Melbourne). Studied under Prof. Orme Masson, and carried out chemical research under Profs. Masson, James Walker, Richard Abegg, and Sir William Ramsay. Have published papers in *Trans. Chem. Soc.*, *Proc. Royal Society*, *Trans. Faraday Soc.*, and elsewhere.

Orme Masson. James Walker.
William Ramsay. Leonard Dobbin.
Sydney A. Kay.

Emslie, Benjamin Leslie,

Glengairn, Oakville, Ontario (Office: 1105, Temple Buildings, Toronto).

Agricultural Chemist and Manager in Canada of the educational propaganda work of the German Potash Syndicate. Holder of Diploma in Agriculture of Glasgow Agricultural College, and of Professional Associateship of the Surveyors' Institution, London; Member of the Royal Society of Arts, London; Fellow of the North British Academy of Arts; Member of the Society of Chemical Industry (Toronto Section); Member of the American Chemical Society. Formerly held position as Agricultural Chemist in the head offices of the German Potash Syndicate at Stassfurt, Germany. Author of "The Stassfurt Potash Salts," published in the *Journal of the Society of Chemical Industry*, under date of April 30th, 1909. Author of "Artificial Fertilisers: their Nature and Use," first published in *The Farmers' Advocate*, of London, Canada, during February and March, 1908. Translator of "On the Assimilation of the Elements of Nutrition by Plants during Different Periods of their Growth," being researches of the Ducal Agricultural Experiment

Station, Barnburg, Anhalt, Germany, and published by Vinton & Co., Ltd., London, E.C., in 1906.

W. R. Lang.
W. Lash Miller.
W. H. Ellis.
James McCutcheon.
R. A. Berry.

Everest, Arthur Ernest,
Clifton House, Shrewsbury.

Priestley Research Scholar, University of Birmingham. B.Sc., Birmingham. Priestley Research Scholar, 1908–09, and 1909–10.

Percy F. Frankland.
Alex. Findlay.
Hamilton McCombie.
Thos. J. Murray.
C. K. Tinkler.
Thomas H. Pope.

Forster, Aquila,
156, Coatsworth Road, Gateshead-on-Tyne.

Prize Demonstrator in Chemistry at Armstrong College, Newcastle-on-Tyne. Bachelor in Science, Durham University. Author of "Note on Benzyl Ethyl Ether," in Proceedings of the Durham University Philosophical Society.

P. Phillips Bedson.
J. A. Smythe.
F. C. Garrett.
S. Hoare Collins.
Herbert Blair.

Handley, John,
P.O. Box 247, New Liskeard, Ontario, Canada.

Mining Engineer and Assayer. 1897 : Part I and II Diploma in Agriculture, Cambridge. 1907 : Elected Associate Member Canadian Soc. Civil Engineers; Member Canadian Mining Institute. 1897–1907: Assistant, and in charge, Assaying and various engineering works in Canada. 1907 to present time in private practice as Engineer and Assayer.

T. B. Wood.
R. A. Berry.
M. J. R. Dunstan.
John Golding.
J. F. Blackshaw.

Hayhurst, Walter,
Tremellen Street, Accrington.

Teacher. B.Sc. (Manchester University). Chief Science Lecturer and Demonstrator in the Pannal Ash College, Harrogate. Actively engaged in Chemical research.

Jas. Grant.
Stanley J. Peachey.
Fred. G. Richards.
L. G. Radcliffe.
F. S. Sinnatt.
E. L. Rhead.

Hughes, Herbert Hillier,
22, Ranelagh Road, Tottenham, N.

Science Master (at Tottenham Grammar School). B.Sc. of London University; Chemistry taken at Final. Student of Chemistry at Stafford Technical School, and Mason Univ. Coll., Birmingham. Science Master (including Chemistry) for last six years.

R. Henry Jones. Arthur Adams.
A. B. Coles. *Allan Baguley.*
T. Slater Price.

Jaques, Arthur,
23, St. Oswin's Avenue, Cullercoats, Northumberland.

Student of Chemistry. B.Sc. (Dunelm). Published articles in *Chem. News*, Vol. 88 (295); Vol. 90 (107); Vol. 96 (77). Late Lecturer in Chemistry and Demonstrator in Physics, Magee College, Londonderry; late Fellow of Armstrong College, Newcastle-on-Tyne. Have done two years' research work in Electrochemistry under Professor Abegg, Breslau. Wish to take in the Journal and use the Library.

P. Phillips Bedson. S. Hoare Collins.
F. C. Garrett. Herbert Blair.
J. A. Smythe. John Watson.

Jenkins, Leslie Charles W.,
31, Eastcombe Avenue, Charlton, Kent.

English representative for Hard and Foreign wood importers. Studying Analytical Chemistry under Prof. Raphael Meldola. Specially working in dyeing woods, etc. Special investigation with reference to alloys, and general analytical work.

Thos. R. Duggan. B. S. Bull.
R. Meldola. *A. E. Bell.*
A. Harrison.

Krall, Hans,
Trinity College, Dublin.

Student. Senior Moderator (Experimental Science), B.A. (T. C. D.), 1908. Science Master, Rathmines College, 1908–09. Research Student, University Chemical Laboratory, T. C. D. (since 1909).

Sydney Young. Wm. C. Ramsden.
Emil A. Werner. Wm. Caldwell.
James H. Pollok.

Lavender, John Herbert,
27, Parade Street, Barrow-in-Furness.

Assistant Analyst, Vickers, Sons & Maxim, Naval Construction Works; also Lecturer in Chemistry and Metallurgy at Technical

School, Barrow-in-Furness. Late Staffordshire County Council Scholar in Metallurgy at Birmingham University, 1906–09. Formerly Demonstrator in Chemistry and Physics in West Bromwich Science School, and afterwards in the Municipal Secondary School. 3rd Stage Inorganic Chemistry and 3rd Stage Metallurgy (Board of Education Examinations). Full Technological Certificate, Iron and Steel Manufacture (City and Guilds Examinations).

Thomas Turner. T. Slater Price.
R. Lloyd Whiteley. Alex. Findlay.
W. J. Lancaster.

Lewis, Samuel Judd.

122, Newington Causeway, S.E.

Analytical and Consulting Chemist. Most important contributions to scientific literature are a Doktor Dissertation, and some half-dozen papers on Zirconium. Also a few papers to Pharmaceutical literature. B.Sc. (Lond.), F.I.C., Ph.C., Ph.D. (Tübingen). Have held appointment for 8 years as Analytical and Industrial Chemist. Now practising as Analytical and Consulting Chemist.

J. Norman Collie. William Ramsay.
A. G. Bloxam. Arthur R. Ling.
Samuel Smiles.

Marcan, Alexander,

Royal Mint, Bangkok, Siam.

Chief Assayer, Royal Mint, Bangkok, Siam. Associate of the Institute of Chemistry.

R. Meldola. S. B. Schryver.
M. O. Forster. William A. Tilden.
W. Gowland.

Meanwell, Charles Wright,

15, Woodlands Crescent, Muswell Hill Road, N.

Analytical Chemist at Messrs. Thos. De La Rue & Co., Ltd., 110, Bunhill Row, E.C. School training at Middle Class Schools, Cooper Street, E.C., under Prof. F. S. Barff. Three years' training at "Young" Chair of Technical Chemistry, Anderson's College, Glasgow, under Prof. E. J. Mills, F.R.S. (1879–1881). Joint paper with Prof. Mills on "The Action of Oxides on Salts. Part III" (*Journal of the Chemical Society*, Nov., 1881.) Two short notes contributed to "Handbook of the London Geological Field Class," 1891. Silver Medallist at examination of City and Guilds of London, 1881, on Oils, Colours, etc. Intermediate Examination for B.Sc., London, with Honours in Chemistry, 1882. Twenty-eight years as Chemist with

Messrs. De La Rue & Co., 21 of which under Dr. Hugo Müller, F.R.S. Elected F.I.C., 1887.

Hugo Müller. Edmund J. Mills.
Evelyn de la Rue. A. G. Perkin.
W. J. Cousins.

Murch, Douglas Wilshin,

Selby House, Victoria Road, Wednesbury, S. Staffs.

Chemist at Messrs. Chance & Hunt, Limited. Training: Manchester School of Technology; Messrs. Crace Calvert & Thomson, Analytical and Consulting Chemists, Manchester; University College, Liverpool (Languages). Experience: Assistant Chemist at Messrs. Lever Bros., Ltd. (5 years); Chemist at Messrs. Bowman, Thompson & Co., Ltd. (8 years); Chemist at Messrs. Brunner, Mond & Co., Ltd. (2 years); Chemist at Messrs. Chance & Hunt, Ltd. (7 years).

William Thomson. Edward Jackson.
Fredc. H. Bowman. Francis Henry Tate.
F. E. Bowman. *Alfred C. Fryer.*

Neal, George Williams,

8, Little Park Gardens, Enfield.

Lecturer in Chemistry and Mathematics at the Hackney Pupil Teachers' Centre, London, N.E. Bachelor of Science (Lond.). Lecturer in Chemistry at Hackney Pupil Teachers' Centre, and at Kingsland Science and Art Centre. I am anxious to have access to the Society's publications, and to be acquainted with the results of recent Chemical Research.

W. H. Collier. Frank E. Weston.
H. R. Ellis. Alfred Hyder.
W. H. Ratcliffe.

Nicholson, Philip Brady,

2, Silverwood Terrace, Thrybergh, Rotherham.

Analytical Chemist to Messrs. Simon-Carves, Ltd., Silverwood Colliery, Rotherham. Seven years Assistant Chemist, Messrs. Walter Scott, Ltd., Leeds Steel Works. Five years, studied Chemistry and Metallurgy at the Leeds School of Science. Two years and a-half, Analytical Chemist to Messrs. Simon-Carves Bye-product Coke Oven Construction and Working Co. Ltd., Silverwood Colliery, Rotherham.

R. Wells Varley. Samuel Parrish.
Harry W. Dixon. *W. Sudderick Brakes.*
Oswald F. Kirby.

Palmer, Gilbert,

17, Wansbeck Gardens, West Hartlepool.

Science Master. B.Sc. (Lond.), 1909 (Chemistry, Physics, and Mathematics). Engaged in teaching Chemistry since 1900 at "Organised Science School," Technical College, West Hartlepool, and at Elwick Road School, West Hartlepool.

James C. Philip.
G. T. Morgan.
M. O. Forster.
J. Archyll Jones.
J. W. Patterson.

Rattey, Clifford Clare,

37, Park Avenue, Swinton, near Manchester.

Electro-Chemist. Four years Student of East London College (University of London). Six years Analyst to the Electrical Power Storage Co., Ltd., London (Accumulator Manufacturers). Present position: Head Chemist to the Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester (Accumulator Manufacturers).

J. T. Hewitt.
F. G. Pope.
Clarence Smith.
J. J. Fox.
H. R. Le Sueur.
F. W. Caton.

Rees, John James Beaumont,

Johannesburg College, S. Africa.

Schoolmaster. B.Sc. London (Chemistry). Desirous to keep in touch with the latest researches in Chemistry.

A. E. Dunstan.
W. H. Mills.
A. T. Cameron.
F. Curzon Britten.
W. Bradshaw Tuck.

Russell, John,

"Oaklands," Carsick Hill, Tom Lane, Sheffield.

Science Master (Sheffield Central Secondary School). Honours Degree in Chemistry (Oxford). Engaged in teaching Chemistry, and desirous of keeping in touch with chemical literature.

D. H. Nagel.
N. V. Sidgwick.
N. Garrod Thomas.
T. S. Moore.
Harold Hartley.

Sen, Aswini Kumar,

81/2, Harrison Road, Calcutta, India.

Dyer and Chemist. B.A. (Calcutta University: subjects of study being Chemistry, Physics, and Mathematics); B.Sc. Tech. (Victoria University, Manchester, in Applied Chemistry and Chemical Technology); also holder of the Diploma of the Municipal School of Technology, Manchester, in Applied Chemistry and Chemical Technology.

Jas. Grant. L. G. Radcliffe.
Stanley J. Peachey. F. S. Sinnat.
E. L. Rhead.

Smith, Ernest William,
20, St. Bevan's Road, Halifax.

Head of the Pure and Applied Chemistry Department, Technical College, Halifax. Assistant Lecturer in Chemistry, Technical Schools, Hull, 1903–05. Head of the Chemistry Department, Technical College, Halifax, 1905—present time.

F. Stanley Kipping. Henry J. S. Sand.
R. M. Caven. William Cranfield.
R. Lyon.

Southgate, Herbert William,
130, Horseferry Road, Westminster, S.W.

Physics Lecturer, Westminster College, Horseferry Road, Westminster, S.W. B.Sc. (London). Engaged in Research Work on the Optical Properties of Organic Compounds.

T. Martin Lowry. Edward C. Cyril Baly.
George Senter. W. Bradshaw Tuck.
Frank Lee Pyman.

Stuart, Murray,
27, Chowringhee, Calcutta, India.

Assistant Superintendent, Geological Survey of India. B.Sc., Birmingham, in Geology and Chemistry. February–May, 1905, Acting Chemist to the Birmingham Corporation Gas Works. Publications: "Suitability of Sands in the Rajmahal Hills for Glass Manufacture," "Growth of Alunogen on a Meteorite," *Records Geol. Survey Ind.*, Vol. xxxvii, pt. 2, and "China-Clay and Fireclay Deposits in the Rajmahal Hills," *Rec. Geol. Sur. Ind.*, Vol. xxxviii, pt. 2, etc.

Percy F. Frankland. C. K. Tinkler.
Alex. Findlay. Hamilton McCombie.
Thos. J. Murray. *Edgar P. Hedley.*

Ward, Percy George,
The Lodge, Preston Park, Brighton.

Recently a Student of the Royal College of Science (Lond.); A.R.C.S. (Lond.); B.Sc. (Lond.).

William A. Tilden. G. T. Morgan.
M. O. Forster. J. C. Philip.
Chapman Jones.

Wolfenden, Stuart Jardine Norris,

The Grange, Sidcup, Kent.

Student. Commenced the study of Chemistry some 5 years ago in the laboratory of a Fellow (Mr. P. R. Sanders), and since have followed up the subject at various Public Institutions. Specially interested in Electrochemistry, and wish to keep in touch with literature and latest work on the subject. Going to Cambridge in about a year's time to take Science Tripos Course. Dr. Wolfenden, a past Fellow and well-known investigator in Physiological Chemistry (M.D. Cantab.).

P. R. Sanders.	*J. Connah.*
Frank E. Weston.	*T. J. Cheater.*
Cecil H. Cribb.	*Francis G. H. Tate.*

Young, John,

Highfield, Stanley Road, Teddington, Middlesex.

Analytical Chemist. Studied Chemistry for four years at the Glasgow and West of Scotland Technical College, and obtained the Diploma (A.G.T.C.). Passed the examinations for the Associateship of the Institute of Chemistry (A.I.C.). Employed as Assistant Chemist to Messrs. Thos. De La Rue & Co., Ltd., Manufacturing Stationers, etc.

G. G. Henderson.	William S. Denham.
William Dickson.	Evelyn de la Rue.
Thomas Gray.	*A. Campion.*

James C. Irvine.

The following Certificates have been authorised by the Council for presentation to ballot under Bye-law I. (3):

Buchner, Eduard, Ph.D. (Munich).

Breslau I., Burgstrasse 8.

Professor at the University. Investigator of the fermentation without cells.

Prof. Albert Ladenburg.	Prof. Dr. Theodor Curtius
Prof. Dr. Rich. Abegg.	(Heidelberg).

Horace T. Brown.

Das, Tarak Nas,

31, Bhaironath, Benares City, India.

Chemical Assistant of Dr. Arthur Richardson, Central Hindoo College, Benares. Passed B.Sc. Examination, Allahabad University, in 1907. Has been Assistant in Practical Chemistry for 3 years in the Central Hindu College, Benares, under Dr. Arthur Richardson. Has done independent research on "Reaction of Oxalates," which appeared in the *Chemical News* of June 25, 1909.

A. Sanyal. *Bidhu Bhushan Dutt.*
P. C. Rây.

McBeath, John William,

Kimberley, South Africa.

Chemist, Kimberley Mine Hospital. Passed the Pharmaceutical Society's Exam. in 1878. Chemist to Sir Wm. Gray & Co., West Hartlepool, 16 years. Chief Assayer to A. Davison's Executors, Kimberley, 1894 to 1898. Managing Partner of Albania Salt Works, Griqualand West, 1898 to 1901.

F. J. Pooler. *J. A. Wilkinson.*

Rau, Malur Srinivasa, M.A., M.D., B.Sc. (Edin.), D.P.H. (Cambridge).

Bangalore, South India.

Chemical Analyst and Bacteriologist to the Mysore Govt., Bangalore. Chemical Analyst for the last 13 years in Bangalore; formerly Professor of Chemistry, Doveton Protestant College, Madras. Worked in the Laboratories of the University of Edinburgh, University College, London, and of Mr. C. H. Cribb, Public Analyst, 136, Shaftesbury Avenue.

William Ramsay. Cecil H. Cribb.
Henry Kenwood. *Edward Bevan.*

R. CLAY AND SONS, LTD., BREAD STREET HILL, E.C., AND BUNGAY, SUFFOLK.

[*Issued* 25/2/10.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 367.

Thursday, February 17th, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., F.R.S., President, in the Chair.

Mr. F. V. Darbishire was formally admitted a Fellow of the Society.

Certificates were read for the first time in favour of Messrs.:

Robert Benedict Bourdillon, Buddington, Midhurst, Sussex.
Charles Herbert Bell Longman, 32, Farringdon Street, Swindon.

A Certificate has been authorised by Council for presentation to ballot under Bye-law I. (3) in favour of Mr. Ettore Cardoso, D. és Sc., 3, Grand Rue, Geneva.

It was stated that the following changes in the Officers and Council were proposed by the Council:

Vice-Presidents to retire.—Dr. J. J. Dobbie and Sir Alexander Pedler.

Hon. Secretary to retire.—Dr. M. O. Forster.

Ordinary Members of Council to retire.—Mr. A. Chaston Chapman, Dr. W. R. E. Hodgkinson, Dr. G. T. Morgan, and Prof. A. G. Perkin.

As President.—Prof. Harold B. Dixon.

As Vice-Presidents who have filled the Office of President.—Prof. H. E. Armstrong, Prof. A. Crum Brown, Sir William Crookes, Sir James Dewar, Dr. A. G. Vernon Harcourt, Prof. R. Meldola, Dr. H. Müller, Prof. W. Odling, Sir William Ramsay, Prof. J.

Emerson Reynolds, The Rt. Hon. Sir Henry E. Roscoe, Sir Edward Thorpe, and Sir William Tilden.

As Treasurer.—Dr. Alexander Scott.

As Hon. Secretaries.—Prof. Arthur W. Crossley and Dr. G. T. Morgan.

As Foreign Secretary.—Dr. Horace T. Brown.

As Vice-Presidents.—Dr. M. O. Forster and Prof. A. Liversidge.

As New Ordinary Members of Council.—Prof. Adrian J. Brown, Dr. A. McKenzie, Dr. J. C. Philip, and Sir Boverton Redwood.

Dr. J. A. Voelcker, Dr. V. H. Veley, and Dr. F. B. Power were elected Auditors to Audit the Society's Accounts.

A ballot for the election of Fellows was held, and the following were subsequently declared elected:

Percival Frederick Adams.
Gilbert Grahame Auchinleck, B.Sc.
Fred Banister, B.Sc.
Herbert Arthur Berens.
Eduard Buchner, Ph.D.
Howard Canton.
Arthur James Child.
Reginald Henry Cocks, M.A.
Leonard Harry Cooper.
Bernard Okes Coventry.
Alexander Charles Cumming, D.Sc.
Tarak Nas Das, B.Sc.
Benjamin Leslie Emslie.
Arthur Ernest Everest, B.Sc.
Aquila Forster, B.Sc.
John Handley.
Walter Hayhurst, B.Sc.
Herbert Hillier Hughes, B.Sc.
Arthur Jacques, B.Sc.
Leslie Charles W. Jenkins.
Hans Krall, B.A.
John Herbert Lavender.
Samuel Judd Lewis, B.Sc., Ph.D.
Alexander Marcan.
John William McBeath.
Charles Wright Meanwell.
Douglas Wilshin Murch.
George Williams Neal, B.Sc.
Philip Brady Nicholson.
Gilbert Palmer, B.Sc.
Clifford Clare Rattey.
Malur Srinivasa Rau, M.A., M.D., B.Sc.
John James Beaumont Rees, B.Sc.
John Russell, B.A.
Aswini Kumar Sen, B.A., B.Sc.
Ernest William Smith.
Herbert William Southgate, B.Sc.
Murray Stuart, B.Sc.
Percy George Ward, B.Sc.
Stuart Jardine Norris Wolfenden.
John Young.

The PRESIDENT stated that he had been asked to call the attention of Fellows to a letter signed by Colonel Hime, Sir G. Greenhill and Mr. Oscar Guttmann, in which a proposal was outlined to erect a memorial to Roger Bacon.

The Julius Thomsen Memorial Lecture was delivered by SIR EDWARD THORPE, C.B., F.R.S., and at its conclusion SIR WILLIAM TILDEN, in proposing a vote of thanks, said everyone present would acknowledge that Sir Edward Thorpe had laid the Society under a new obligation for the interesting lecture just added to the long list of biographical notices with which he had enriched the pages of the Journal. With regard to the subject of the lecture, he (the speaker) acknowledged that he had learned a great deal, because, although the four volumes of *Thermochemische Untersuchungen* occupied a prominent place on his book-shelves, he had been apt to forget that Thomsen's name should also be connected with other subjects. As to his laborious investigations in Thermal Chemistry, if it were admitted that we were still waiting for their complete interpretation, it should be remembered that every exact observation or experiment duly recorded would assist, sooner or later, in the progress of science. On this account Thomsen's name would long be held in honoured remembrance by the chemical world.

Professor JAMES WALKER said that to him, as to many another physical chemist, Julius Thomsen was merely a name, a great name it was true, but still only a name, one associated with certain numerals prefixed to the designation calories. He, therefore, personally owed sincere gratitude to Sir Edward Thorpe, not only for the excellent sketch he had given of Thomsen's wider activity in pure science, but also for his vivid presentation of Thomsen as a practical man, as a good citizen, and as a stout fighter—in short, as a human being. Similar feelings of gratitude must exist in the minds of all Fellows present, and he therefore had the greatest pleasure in seconding the vote of thanks to Sir Edward Thorpe for his admirable address.

The PRESIDENT was glad to say that Julius Thomsen was something more than a name to him, for it was his good fortune, some twenty-seven years ago, to catch the Professor in his laboratory, and he possessed and treasured a specimen of cryolite given him by Julius Thomsen. In putting the resolution to the meeting he wished to add only one word to the eloquent phrases in which Sir William Tilden had expressed their thanks, and that was that no more ideal choice could have been made of a lecturer on Julius Thomsen, for surely their lecturer was a man and a chemist—even sometimes "a fighting chemist"—after Thomsen's own heart.

The vote of thanks was carried by acclamation and acknowledged by Sir Edward Thorpe.

Of the following papers, those marked * were read :

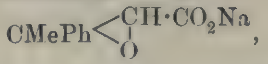
*44. "Attempted resolution of racemic aldehydes."
By William Ord Wootton.

The author described experiments having for their object the resolution of racemic aldehydes of the type CHRR′·CHO into their optical antipodes by combination with optically active bases, such as 3-*aminophenyl-a-camphoramic acid*,

$$CO_2H{\cdot}C_8H_{14}{\cdot}CO{\cdot}NH{\cdot}C_6H_4{\cdot}NH_2.$$

In no case, however, was a resolution effected.

Sodium d-*β-phenyl-β-methylglycidate*,



$$\mathrm{CMePh}{<}\begin{array}{l}\mathrm{CH\cdot CO_2Na}\\ |\\ \mathrm{O}\end{array},$$

was obtained by resolution of the corresponding *brucine* salt, but this yielded an optically inactive hydratropaldehyde when decomposed by an acid.

A number of new nitro-derivatives of benzylidenecamphor have been prepared, with a view to utilising the corresponding amines in the resolution of racemic aldehydes. The small yields resulting from the condensation of sodium camphor with the three nitrobenzaldehydes, however, have precluded the general application of these substances.

*45. "The influence of colloids and fine suspensions on the solubility of gases in water. Part I. Solubility of carbon dioxide and nitrous oxide." By Alexander Findlay and Henry Jermain Maude Creighton.

The influence of ferric hydroxide, gelatin, arsenious sulphide, silicic acid, dextrin, starch, glycogen, egg-albumen, and serum-albumen, as well as of suspensions of charcoal and silica, on the solubility of carbon dioxide and nitrous oxide has been studied at pressures varying from about 750 mm. to about 1400 mm. Under atmospheric pressure, silicic acid increases the solubility both of carbon dioxide and of nitrous oxide; ferric hydroxide and gelatin increase the solubility of carbon dioxide, but diminish the solubility of nitrous oxide; arsenious sulphide is practically without influence on the solubility of either gas; charcoal and silica increase the solubility of both gases. The other substances diminish the solubility of both gases.

Various types of solubility-pressure curves have been obtained: 1. Where increased solubility is found, then at higher pressures the solubility curve (*a*) remains nearly horizontal, or falls to a flat minimum (carbon dioxide in presence of silicic acid, ferric hydroxide, gelatin); (*b*) rises continuously (carbon dioxide and nitrous oxide in presence of charcoal and silica, and nitrous oxide in presence of silicic acid). 2. Where decreased solubility occurs, then at higher pressures the solubility curve may either rise continuously or, generally, fall to a minimum and then rise more or less steeply. The cases under 1(*a*) are probably best explained on the basis of chemical interaction; those under 1(*b*) on the basis of "adsorption." The behaviour in the cases under 2 probably depends on the action of two factors, namely, solubility of the gases in a polymerised form in the colloid phase (descending portion of the curve), and "adsorption" (rising portion of the curve).

46. "The absorption spectra of the vapours of pyridine and some of its derivatives at different temperatures and pressures." By John Edward Purvis.

The spectra of the vapours of pyridine, α-picoline, 2 : 4-lutidine, 2 : 6-lutidine, 2 : 4 : 6-trimethylpyridine, and piperidine were examined under the conditions of increased temperatures and pressures and at two definite temperatures and decreased pressures. The chief results are :

(1) Pyridine vapour exhibits a considerable number of absorption bands, most of which can be arranged in groups, in having similar appearances and regular differences of wave-lengths. Increased temperatures and pressures cause the bands to widen and new bands to make their appearance, and the general absorption is shifted towards the red end of the spectrum.

(2) α-Picoline shows a considerably less number of bands than the vapour of pyridine, and those which appear are comparable with those of pyridine, and a few bands appear which are not seen in pyridine.

(3) The two lutidines and trimethylpyridine do not exhibit any of the various bands characteristic of pyridine or of α-picoline, but they indicate the presence of a strong absorption band in the ultraviolet region analogous to one found in the other vapours.

(4) Piperidine gives a number of bands which can be divided into groups, and which are unlike those of pyridine.

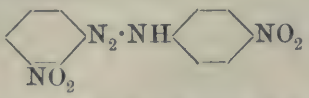
The results were discussed from the point of view of the vibrations of the atoms of the molecules, when the hydrogen atoms are replaced by methyl groups in the pyridine nucleus, and by the addition of hydrogen atoms in piperidine. They were also compared with the bands observed in alcoholic solutions.

47. "Absorption spectra and melting-point curves of aromatic diazoamines." By Clarence Smith and Constance Hamilton Watts.

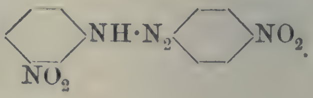
It has been shown by Meldola and Streatfeild that *m*-*p*′-dinitrodiazoethylaminobenzene, obtained by the direct ethylation of *m*-*p*′-dinitrodiazoaminobenzene, is not identical with either *m*-nitrobenzenediazoethylamino-*p*-nitrobenzene, $NO_2{\cdot}C_6H_4{\cdot}N_2{\cdot}NEt{\cdot}C_6H_4{\cdot}NO_2$, or with *p*-nitrobenzenediazoethylamino-*m*-nitrobenzene, but is produced, probably in the form of a compound, by boiling a mixture of equal quantities of the two isomerides in alcohol or benzene.

The absorption spectrum of the directly ethylated compound differs from that of either of the two isomerides, and is identical with that of the parent mixed diazoamine.

The melting-point curve of the two isomerides has the simple U-shape, with the minimum at the melting point of the directly ethylated compound. The latter, therefore, is a solid solution of equal quantities of the two isomerides, and *m*-*p*′-dinitrodiazoaminobenzene, which is shown by the spectrometric evidence to have a similar constitution, is a solid solution of equal quantities of the two compounds:



and



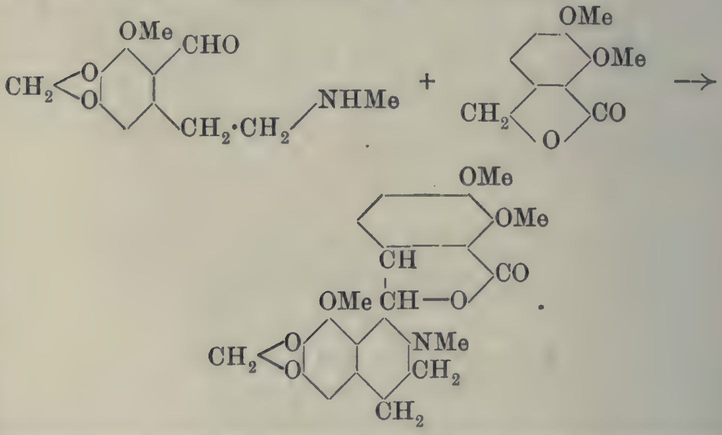
Other sets of triplets are being examined.

48. "Synthesis of *dl*-narcotine (gnoscopine)." Preliminary note.

By William Henry Perkin, jun., and Robert Robinson.

During the course of some experiments on the synthesis of the alkaloids, the authors have found that gnoscopine is produced when cotarnine and meconine are boiled in alcoholic solution with potassium carbonate. The synthetical alkaloid melts at 229°, and this melting point was unaltered by admixture with a specimen of gnoscopine from opium, of the some melting point, for which the authors are indebted to Messrs. T. and H. Smith, of Edinburgh.

The synthesis takes place according to the scheme:



The authors intend to apply this reaction to the synthesis of hydrastine, and to complete the synthesis of narcotine, narceine, etc., by resolving gnoscopine into its optically active components and by converting the cotarnic acid which has recently been synthesised (*Trans.*, 1909, **95**, 1977) into cotarnine.

49. "Isomeric chromous chlorides."
By William Arthur Knight and Elizabeth Mary Rich.

A rapid and convenient method of preparing pure chromous chloride was described. A dark green modification of the dark blue hydrate, $CrCl_2,4H_2O$, has been found to exist; its solution contains the ions $CrCl^{\cdot}$ and Cl'. Two other new hydrates, $CrCl_2,3H_2O$ (pale blue) and $CrCl_2,2H_2O$ (pale green), have also been prepared.

50. "The chromous chlorides." By William Arthur Knight.

The author has measured several transition points between the solid hydrates of chromous chloride (see preceding paper), and the vapour tensions of several of these systems at various temperatures were determined.

Cryoscopic measurements confirm the results described in the preceding paper, that the blue tetrahydrate is dissociated into three, and the green modification into two, ions.

51. "Silver amalgams." By Chapman Jones.

The author described a method of preparing definite and homogeneous silver amalgams. By the reduction of double or mixed halogen compounds of the metals, amalgams of the compositions: Ag_2Hg, $AgHg$, $AgHg_2$, $AgHg_3$, $AgHg_5$, etc., are obtained. An account of some of the properties of the compounds $AgHg$ and $AgHg_3$ was given.

52. "Derivatives of *S*-phenylphenazothionium. Part III."
By Edward de Barry Barnett and Samuel Smiles.

The constitution of the substances obtained by condensation of aromatic derivatives with the diphenylamine *o*-sulphoxides was further discussed, and the analogy between these substances and the simpler phenazothionium salts was shown. The conditions which control the formation of these *S*-phenyl derivatives were dealt with, special reference being made to (*a*) the nature of the sulphoxide, and (*b*) the aromatic compound employed in their formation. Some dyestuffs of this series were also briefly described.

53. "The vapour pressures of two perfectly miscible solids and their solid solutions." By Ernest Vanstone.

In a former paper (*Trans.*, 1909, **95**, 590) it was shown that camphor and borneol form a continuous series of solid solutions. The vapour pressures of these substances and of a complete series of solid solutions have been measured. The barometric and air-current methods were employed with concordant results. The values obtained for the vapour pressures of camphor are in all cases lower than those of former investigators. The following are the conclusions drawn:

(1) For camphor and borneol, the ratios of the absolute temperatures, corresponding with equal vapour pressures, are constant.

(2) The vapour pressures of solid solutions follow the ordinary mixture law: $P_S = nP_A + (100 - n)P_B/100$, where P_A and P_B are the vapour pressures of the pure subtances A and B, and n = number of molecules of A per 100 of mixture.

(3) The molecular weights of camphor and borneol in the solid solutions are probably normal, also the densities of the vapours at the temperatures employed.

At the next Ordinary Scientific Meeting on **Thursday**, March 3rd, 1910, at **8.30** p.m., the following papers will be communicated:

"Phenomena observed when potassium mercuric iodide is dissolved in ether and water." By J. E. Marsh.

"The relation between absorption spectra and chemical constitution. Part XIV. The aromatic nitro-compounds and the quinonoid theory." By E. C. C. Baly, W. B. Tuck, and Miss E. G. Marsden.

"Action of ethyl cyanoacetate on 5-chloro-1:1-dimethyl-Δ^4 *cyclo*-hexen-3-one." By A. W. Crossley and C. Gilling.

"The constitution of carpaine. Part I." By G. Barger.

"Optically active glycols derived from *l*-benzoin and from methyl *l*-mandelate." By A. McKenzie and H. Wren.

"The colour and constitution of azo-compounds. Part V." By J. T. Hewitt and F. B. Thole.

"The direct union of carbon and hydrogen at high temperatures. Part II." By J. N. Pring.

"Affinity relations of cupric oxide and of cupric hydroxide." By A. J. Allmand.

"3-Aminoquinoline and the colour of its salts." By W. H. Mills and W. H. Watson.

R. CLAY AND SONS, LTD., BREAD STREET HILL, E.C., AND BUNGAY, SUFFOLK.

[*Issued* 11/3/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 368.

Thursday, March 3rd, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., F.R.S., President, in the Chair.

Messrs. A. J. Child, R. H. Cocks, H. H. Hughes, L. C. W. Jenkins, and H. W. Southgate were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Oscar Lisle Brady, B.A., 51, Upper Bedford Place, W.C.
Henry Leslie Farmer Buswell, B.A., 169, Queen's Gate, S.W.
Thomas Patrick Cheetham, Vrijheid, Natal, S.A.
Thomas William Dickson, B.A., 153, Finborough Road, South Kensington, S.W.
Harold Albert Goldsbrough, Churchside, Herne Hill, S.E.
James Kenner, Ph.D., B.Sc., 61, Marlborough Road, Sheffield.
Sea-Kwain Kwoh, 125, Acomb Street, Manchester.
Samuel Lamb, May Villa, Birmingham Road, West Bromwich.
Knowles Preston, Newhaven, Camden Avenue, Feltham, Middlesex.

Certificates have been authorised by the Council for presentation to Ballot under Bye-law 1 (3) in favour of Messrs.:

Georges Baume, 44, Quai des Eaux, Vive, Geneva.
Motilal Kashalchand Shah, Byculla Bridge, Byculla, Bombay.

The PRESIDENT read the names of the Fellows recommended by the Council for election as Officers and Ordinary Members of Council of the Society.

It was stated that the Society had become indebted to Mr. Ernest de la Rue for a portrait of the late Dr. Warren de la Rue, who was President of the Chemical Society from 1867 to 1869, and again from 1879 to 1880.

The President announced also that the banquet to the Past-Presidents who have completed fifty years of fellowship would be held at the Savoy Hotel on Thursday, May 26th, 1910.

Of the following papers, those marked * were read :

*54. "Phenomena observed when potassium mercuri-iodide is dissolved in ether and water." By James Ernest Marsh.

The salt KI,HgI_2,H_2O dissolves in ether with evolution of heat, and this solution dissolves water with a further evolution of heat. On the other hand, water acts on the double salt with absorption of heat and with separation of part of the mercuric iodide ; the addition of ether to this mixture brings about complete solution with evolution of heat.

A solution of one molecular proportion of potassium and mercuric iodides in seventeen molecular proportions of ether and water separates, on warming, into three layers. As the temperature rises, the middle layer gradually diminishes in quantity and disappears. On cooling, the middle layer reappears again, and increasing in quantity as the temperature falls, eventually absorbs the other two.

A solution of less concentration than the above gives, on warming, two layers, the upper one increasing as the temperature rises and being re-absorbed as the temperature falls. With a solution of greater concentration, two layers are also formed on warming, but in this case it is the lower layer which increases with the temperature and is re-absorbed on cooling.

When potassium iodide and mercuric iodide in molecular proportions are dissolved in cold ether with the addition of sufficient water to form the double salt KI,HgI_2,H_2O, the latter crystallises on warming the solution, but redissolves on cooling.

In dry ether the two salts dissolve, forming a heavy liquid of the composition $KI,HgI_2,4Et_2O$, which does not appreciably dissolve in excess of ether.

Discussion.

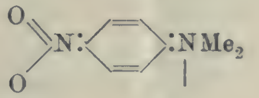
Mr. Marsh, in reply to Mr. Carr, said that the salt $2KI + HgI_2$ did not bring about the miscibility of ether and water to the same extent as the salt $KI + HgI_2$, nor was the effect of change of temperature so marked.

*55. "The relation between absorption spectra and chemical constitution. Part XIV. The aromatic nitro-compounds and the quinonoid theory." By Edward Charles Cyril Baly, William Bradshaw Tuck, and Effie Gwendoline Marsden.

It has been proved (*Trans.*, 1908, **93**, 1747) that the nitro-group possesses a free period of vibration, and it follows that if in any compound the nitro-group is in conjunction with a system which also has a free period of vibration, the substance will show an absorption band arising from the isorropesis which takes place. Such compounds are to be found in the substituted nitrobenzenes, where the substituent groups are of the so-called positive type. For example, the nitronaphthalenes, nitrofluorene and nitroquinol dimethyl ether all show well marked absorption bands. The position of the absorption bands depends on the position of the band of the group in conjunction with the nitro-group. The results described throw some doubt on the validity of the quinonoid theory, strong evidence being obtained from the nitrodimethylanilines and the nitrobenzylideneanilines. The position of the absorption band in the nitro-compounds is found to vary with the residual affinity of the solvent. An increase in the residual affinity causes a shift in the band towards the red.

Discussion.

Dr. Hewitt agreed with Mr. Baly in so far as his results pointed to a similarity in constitution for the salts of *p*-nitrophenol and for free *p*-nitroaniline and its dimethyl derivative. He differed, however, in thinking that a quinonoid constitution for *p*-nitrodimethylaniline was not excluded; a substance containing strongly positive and negative groups in the same molecule might well be an internal salt, and a structure such as



was by no means improbable.

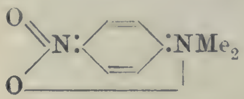
Dr. Lowry said that he was able to confirm from his own observations the migration of a band towards the visible region on displacing hydrogen by sodium, and in the opposite direction on displacing hydrogen by acetyl, and also the identity of the spectra of compounds containing the radicles $\cdot NH_2$ and $\cdot ONa$; but he did not believe that the nitro-group was capable of producing an absorption band except when acting in conjunction with other unsaturated groups. Such groups were present in nitrobenzene and in nitrostyrene, but not in nitromethane or in nitroethane; the latter compounds were, however, very unstable, and the bands (which were not produced by nitrocamphane) might be attributed to decomposition products.

The quinonoid formula for sodium *o*-hydroxycinnamate did not necessarily involve the attachment of sodium to carbon, as the compound might be written: $O{:}C_6H_4{:}CH\cdot CH{:}C(ONa)_2$.

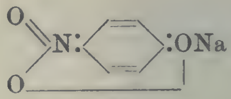
Dr. Morgan said that one interesting point in the paper which had not been referred to by previous speakers was the fact, demonstrated by the authors, that the aromatic meta-nitroamines had absorption spectra quite similar to their ortho- and para-isomerides even when, as in the case of 2-nitrodimethyl-*p*-toluidine, the migration of a labile hydrogen atom could not take place. The colour of these meta-nitroamines was often more intense than that of their ortho- and para-isomerides, and this circumstance negatived the view that the colour of the ortho- and para-series was due to the existence in these compounds of ortho- and para-quinonoid structures respectively. Another weak point in the quinone hypothesis as regards aromatic derivatives was the fact that the heteronuclear nitro-α-naphthylamines (1:5- and 1:8-) were red, whilst the possibly quinonoid ortho- and para-nitro-α-naphthylamines were less intensely coloured.

The view that colour was dependent on unsaturation or residual affinity was supported by the study of 6-aminocoumarin. This base and its alkyl and dialkyl derivatives were yellow; but when the nitrogen present passed from the tervalent to the quinquevalent condition, the colour disappeared, and the yellow 6-aminocoumarin yielded colourless salts, quaternary halides, and diazonium derivatives.

Mr. Baly, in reply to Dr. Hewitt, said that it was not possible that the absorption curve obtained with an aqueous solution of *o*-nitrophenol could be a summation curve of those given by *o*-nitrophenol in alcoholic solution and by sodium *o*-nitrophenoxide. In reference to the quinonoid formula suggested for the *o*- and *p*-nitroanilines and their dimethyl compounds, namely (I):



(I.)



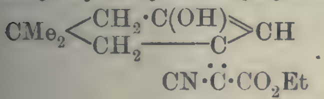
(II.)

since the absorption spectra of the nitroanilines and the corresponding sodium nitrophenoxides were identical, it would be necessary to write similar formulæ for the latter, for example (II), and, as Dr. Hewitt had agreed that this was improbable, it followed that it was equally improbable for the nitroanilines. With regard to Mr. Buttle and Dr. Hewitt's work on picric acid and trinitroanisole, this was dealt with in the paper, where it was shown that their results were capable of a simple explanation.

In reply to Dr. Lowry, he did not understand the objection to the statement that the nitro-group had a free period of absorption, because there seemed to be no doubt whatever on that point as the result of the examination of a great number of compounds.

*56. "Action of ethyl cyanoacetate on 5-chloro-1 : 1-dimethyl-Δ^4-*cyclo*hexen-3-one." By Arthur William Crossley and Charles Gilling.

It has been shown (*Trans.*, 1909, **95**, 27) that during the action of ethyl malonate on chlorodimethyl*cyclo*hexenone, a solid nitrogenous by-product melting at 141° is obtained, its formation being due to the fact that the ethyl malonate employed contained some ethyl cyanoacetate. When the latter substance is used instead of ethyl malonate in the above condensation, there is produced 75 per cent. of the theoretical quantity of the substance melting at 141°, which has been shown by a detailed study of its properties and transformations to be ethyl hydroxydimethyl*cyclo*hexenylidenecyanoacetate,



$$\mathrm{CMe_2}<\begin{matrix}\mathrm{CH_2\cdot C(OH)}\\ \mathrm{CH_2}\text{———}\underset{\mathrm{CN\cdot C\cdot CO_2Et}}{\overset{}{\mathrm{C}}}\end{matrix}>\mathrm{CH}\ .$$

57. "The constitution of carpaine. Part I." By George Barger.

Carpaine, the alkaloid from the leaves of the Papaw tree, *Carica Papaya*, L., was discovered by Greshoff, and has been further examined by Merck and by van Ryn (*Arch. Pharm.*, 1897, **235**, 332), who found that it is a secondary base of the formula $C_{14}H_{25}O_2N$.

In the present investigation it has so far been shown that carpaine is hydrolysed by acids and baryta to a substance, $C_{14}H_{27}O_3N$, soluble in water, which contains a carboxyl group and is also a base. It closely resembles certain amino-acids, and the name *carpamic acid* is suggested for it. When heated with alcoholic hydrogen chloride, carpaine yields the hydrochloride of *ethyl carpamate*, $C_{13}H_{26}ON\cdot CO_2Et,HCl$. The hydrochloride of carpaine is transformed by chlorine into a very unstable, neutral *substance*, $C_{14}H_{23}O_3NCl_2$, insoluble in water and melting at 77° after crystallisation from methyl alcohol. The yield of all the above substances is quantitative. On oxidation by potassium permanganate in acetone solution, a nitrogenous acid results, from which ultimately a minute quantity of a crystalline dibasic acid, $C_8H_{14}O_4$, can be obtained, probably $\alpha\delta$-dimethyladipic acid. The latter acid is also produced, in very much larger quantity, by oxidation of carpaine with nitric acid.

58. "Optically active glycols derived from *l*-benzoin and from methyl *l*-mandelate." By Alex. McKenzie and Henry Wren.

The preparation of a number of optically active glycols derived from *l*-benzoin and from methyl *l*-mandelate was described. Whilst *l*-benzoin and certain of its derivatives, such as the methyl ether, undergo racemisation with great ease in the presence of alkali, this racemisation is prevented when the carbonyl group in *l*-benzoin is displaced by the CRR·OH group.

With one exception, the glycols described are dextrorotatory; *l*-triphenylethylene glycol, for example, has $[\alpha]_D + 221{\cdot}3°$ in acetone solution, and, since the same compound may be obtained either from *l*-benzoin or from methyl *l*-mandelate, the change of sign is probably not due to a Walden inversion.

When *l*-triphenylethylene glycol is alkylated by a mixture of methyl iodide and silver oxide, only one of the two hydroxy-groups is methylated. The monomethoxy-compound obtained in this manner has the formula $OMe{\cdot}CHPh{\cdot}CPh_2{\cdot}OH$, and not

$$OH{\cdot}CHPh{\cdot}CPh_2{\cdot}OMe,$$

and has $[\alpha]_D + 185{\cdot}3°$ in acetone solution.

59. "The colour and constitution of azo-compounds. Part V." By John Theodore Hewitt and Ferdinand Bernard Thole.

The authors have isolated benzeneazobenzenediazonium salts (chloride, platinichloride, and chromate or dichromate) in a solid form. Whilst the two former salts were analysed, the salt of chromic acid proved too explosive (compare Meldola and Eynon, *Trans.*, 1905, **87**, 4). The chloride is characterised by great stability, and may be kept for months in a solid state without undergoing appreciable change, whilst its alcoholic solution does not undergo rapid decomposition. From a comparison of the absorption spectrum of this salt with those of aminoazobenzene hydrochloride and benzeneazophenyltrimethylammonium iodide, no deductions are drawn as to its constitution, but attention is drawn to this further case of stability of diazonium salts being greatly increased by negative substituents in the para-position.

Iodoazobenzene in alcoholic hydrogen chloride gives an absorption spectrum which renders it probable that an iodonium salt,

$$C_6H_5{\cdot}NH{\cdot}N{:}C_6H_4{:}I{\cdot}Cl,$$

is produced. Possibly the compound is formed with two molecules of hydrogen chloride.

60. "The direct union of carbon and hydrogen at high temperatures. Part II." By John Norman Pring.

In continuation of an earlier investigation (Pring and Hutton, *Trans.*, 1906, **89**, 1591), the author has made a quantitative study of the reaction between carbon and hydrogen at temperatures ranging from 1100° to 2200°. The materials used were submitted to the most exhaustive purification, and the presence of moisture and nitrogen was carefully eliminated. The carbon was heated electrically, and out of all contact with any possible source of contamination. Direct union with hydrogen was found to occur at all temperatures, methane being formed below 1800°, and methane, acetylene, and ethylene above this temperature. The formation of methane reached a minimum (0·16 per cent.) at about 1550°.

Some experiments carried out on the decomposition of acetylene and methane showed that at 1775° the former gas changes quickly into the latter, and the methane decomposes only very slowly. At 1200°, small percentages of acetylene in an excess of hydrogen were found to change slowly into methane and ethylene. In presence of platinum, the reaction between the carbon and the hydrogen was very much accelerated, and values were obtained which, at 1200°, amounted to 0·55 per cent., and at 1500° to 0·30 per cent., of methane. On decomposing an excess of methane, an amount equal to 0·59 per cent. of the gas at 1200°, and 0·33 per cent. at 1500°, remained; consequently, these numbers probably represent equilibrium values, in presence of platinum, at the temperatures mentioned.

61. "Affinity relations of cupric oxide and of cupric hydroxide" By Arthur John Allmand.

Crystalline cupric hydroxide is stable in ordinary moist air. When, however, it is shaken with alkaline or ammoniacal solutions at 25°, it loses water and becomes converted into cupric oxide. These two facts are apparently contradictory, and to explain them, tensimetric and electrometric experiments have been carried out, leading to the following results.

(*a*) Freshly-prepared cupric oxide *ages* with time, and its free energy content thereby falls.

(*b*) This ageing is attributed to increasing molecular complexity—not to crystallisation or to surface changes—and is irreversible.

(*c*) The explanation given accounts qualitatively for the electromotive behaviour of samples of copper oxide which have been subjected to varying thermal treatment, and may perhaps throw some light on phenomena noticed in the determination of dissociation pressures of certain oxides at higher temperatures.

(*d*) The tensimetric and electrometric evidence shows that crystalline cupric hydroxide is stable with respect to freshly-prepared cupric oxide and unstable with respect to aged samples of cupric oxide. A saturated solution of cupric hydroxide is unsaturated with respect to "fresh" cupric oxide, and supersaturated with respect to "aged" cupric oxide, which fact explains the apparently anomalous stability relations of cupric hydroxide, on the one hand, and cupric oxide and water on the other.

(*e*) The free energy changes associated with a number of reactions at the ordinary temperature have been measured or calculated.

(*f*) The dissociation pressure of cupric oxide at 1030° has been deduced, and shows excellent agreement with the experimentally determined values.

62. "3-Aminoquinoline and the colour of its salts."

By William Hobson Mills and Walter Henry Watson.

Quinoline-3-carboxylic acid has been prepared by a new method, and converted into 3-*aminoquinoline*, which exists in two forms, melting at 84° and 94° respectively. The salts of the base with one equivalent of acid are intensely yellow and fluorescent. The gradual addition of acid to the solution of a fixed amount of base is accompanied by remarkable variations of colour intensity, which are explained as being chiefly due to the formation of a semi-hydrochloride. In addition to a number of salts of the base, the following compounds have been prepared: *quinoline-3-carboxylamide*, 3-*acetylaminoquinoline*, 3-*quinolineazo*-β-*naphthol*, 3-*hydroxyquinoline*, 2-*chloroquinoline*-3-*carboxylamide*, 2-*chloro*-3-*aminoquinoline*.

63. "The absorption spectra of *p*-toluidine, *m*-xylidine, and of their condensation products with acetaldehyde."

By John Edward Purvis.

From an examination of the absorption spectra of the substances mentioned in the title, the author finds that (1) the absorption curves of *p*-toluidine and *m*-xylidine are very similar; (2) the condensation products with acetaldehyde show a disappearance of the more refrangible band of the original bases; (3) the isomeric α- and β-condensation products show very slight differences in the persistencies of the bands; and (4) the addition of hydrochloric acid to the condensation products has no effect on the form or the persistency of the band.

64. "A supposed case of stereoisomeric tervalent nitrogen compounds." By Humphrey Owen Jones and Edward John White.

Miller and Plöchl (*Ber.*, 1896, **29**, 1462) found that the interaction of *m*-xylidine and acetaldehyde in acid solution gave rise to two compounds of the formula $C_{12}H_{17}ON$: these were supposed to be stereoisomeric compounds containing tervalent nitrogen. This conclusion is at variance with the views now held concerning nitrogen compounds, and these substances have therefore been re-examined.

The method of preparation has been improved, and it is found that the more soluble α-compound melts at 103—104°, while the less soluble β-compound melts at 127—128°.

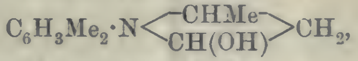
The α-compound is *not* transformed into the β-compound by the action of heat or of solvents, but in acid solution each is transformed into an equilibrium mixture, containing two molecular proportions of the α- and one molecular proportion of the β-compound, and this mixture is gradually transformed into 2 : 6 : 8-trimethylquinoline.

Both compounds give the same oxime, benzoyl derivative, phenylbenzylhydrazone, methyl derivative, and condensation product with *m*-xylidine, but give different products with hydrogen chloride and with nitrous acid.

It is clear that the compounds are not stereoisomerides, and it is suggested that the α-compound has the constitution

$$C_6H_3Me_2\cdot NH\cdot CHMe\cdot CH_2\cdot CHO,$$

whilst the β-compound has the constitution



$$C_6H_3Me_2\cdot N\Big\langle\begin{matrix}CHMe\\CH(OH)\end{matrix}\Big\rangle CH_2,$$

in which the ring readily undergoes fission.

Similar isomeric compounds have been obtained from *p*-toluidine and from ψ-cumidine.

65. "The isolation of stable salt hydrates, with special reference to the stable hydrates of sodium carbonate." By Alexander Charles Cumming.

If a mixture of hydrates is exposed to the dehydrating action of a large supply of the corresponding anhydrous salt, the hydrates lose water until the lowest hydrate is left in a pure state, after which no further dehydration occurs. The next lowest hydrate may be prepared in a similar manner by the use of the lowest hydrate as the desiccating agent. It is very probable that all the hydrates of a salt may be prepared in this manner. The process may be carried out in the reverse direction, that is, a hydrate may be prepared in a pure state by the hydrating action of the next higher hydrate, or in the case of the highest hydrate by the hydrating action of the saturated solution.

These two methods have been applied to the isolation of the monohydrate, heptahydrate, and decahydrate of sodium carbonate. The rates at which these and other hydrates gain or lose water under certain conditions, and some incidental phenomena, such as a well-defined case of suspended transformation, were described.

66. "Salts and ethers of 2 : 3 : 5-trinitro-4-acetylaminophenol." By Raphael Meldola and Harold Kuntzen.

The trinitroacetylaminophenol described in 1906 (*Trans.*, **89**, 1935), which is a pale yellow substance, gives a series of highly coloured and beautifully crystalline salts with metals and certain organic bases. An account of the preparation and properties of these salts was given. The absorption spectrum of the free compound and of its sodium salt, for a study of which the authors are indebted to Dr. J. T. Hewitt, indicates a difference of constitution, and the "*iso*nitro" form is suggested for the salts in explanation of this difference. It was thought possible, in view of the special character of the groups attached to the iminic nitrogen atom in this substance,

$$C_2H_3O\cdot\mathbf{NH}\cdot C_6H(NO_2)_3\cdot OH,$$

in which two acid radicles are associated with one hydrogen atom, that conditions might be favourable for the production of an asymmetric molecule containing a tervalent nitrogen atom. An attempt to resolve the compound by means of its brucine salt led, however, to a negative result, but the experiments in this direction are being continued. The silver salt on methylation gives a *methyl ether* (m. p. 194°), which on hydrolysis by sulphuric acid yields 2 : 3 : 5-*trinitro*-4-*aminoanisole*. The new trinitroanisidine crystallises in dull red, glistening scales melting at 138—139°.

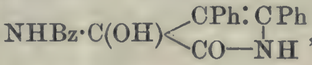
67. "The interaction of hydrogen and chlorine. The inhibitive effect of ozone and chlorine dioxide." (Preliminary note.) By David Leonard Chapman and Patrick Sarsfield MacMahon.

In their last communication on this subject (*Trans.*, 1909, **95**, 1717), the authors expressed the opinion that those substances which prevent or retard the photochemical interaction of hydrogen and chlorine take part in a chemical change with one or more of the constituents of the system hydrogen–chlorine–hydrogen chloride, and that the efficient energy of the chlorine derived from the light is dissipated in causing the change in which the inhibitor participates, thus being rendered incapable of bringing about the union of the hydrogen and chlorine. In complete harmony with this view is the recent discovery that very small quantities of ozone or chlorine dioxide—substances which can obviously react with hydrogen chloride—prevent for a considerable time the interaction of hydrogen and chlorine in light. These effects are being examined in detail, and the influence of other oxidising gases on the interaction of chlorine and hydrogen is being investigated.

68. "Diketodiphenylpyrroline and its analogues. Part III." By Siegfried Ruhemann.

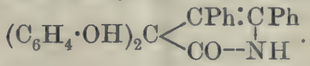
The colourless compound $C_{23}H_{18}O_3N_2$, which is formed together with diketodiphenylpyrroline by the action of sodiobenzamide on ethyl phenylpropiolate, was found not to have the formula

$$NHBz\cdot CPh:CH\cdot CO\cdot NHBz$$

(*Trans.*, 1909, **95**, 984), but  $NHBz\cdot C(OH)<\begin{matrix}CPh:CPh\\ CO-NH\end{matrix}$, for, on boiling with potassium hydroxide, it yields deoxybenzoin besides ammonia, oxalic acid, and benzoic acid, and with cold concentrated sulphuric acid decomposes into diketodiphenylpyrroline and benzamide. The substance $C_{23}H_{18}O_3N_2$, therefore, is an additive compound of the diketopyrroline with benzamide. Further, the diketopyrroline unites with phenylmercaptan or piperidine to form the compounds

$$C_{16}H_{11}O_2N,C_6H_6S$$

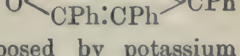
and $C_{16}H_{11}O_2N,C_5H_{11}N$ respectively; it also condenses with phenol in a manner similar to isatin, and yields the compound



$$(C_6H_4\cdot OH)_2C<\begin{matrix}CPh:CPh\\ CO-NH\end{matrix}.$$

The diketopyrrolines give the indophenine reaction.

69. "Triphenyl-2-pyrone." By Siegfried Ruhemann.

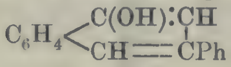
Whereas acetone or acetophenone reacts with ethyl phenylpropiolate and sodium ethoxide to yield 4-pyrone derivatives (*Trans.*, 1908, **93**, 431, 1281), such a condensation does not take place on using *p*-tolyl methyl ketone, propiophenone, or methyl ethyl ketone; the only change which occurs is the hydrolysis of the acetylenic ester. Deoxybenzoin, however, condenses with ethyl phenylpropiolate with the formation of 4 : 5 : 6-*triphenyl*-2-*pyrone*,  $O<\begin{matrix}CO-CH\\ CPh:CPh\end{matrix}>CPh$ (m. p. 245—246°). This compound is decomposed by potassium hydroxide in two directions, namely:

$$(1)\ C_{23}H_{16}O_2 + H_2O = CO_2 + C_{22}H_{18}O,$$

and yields an alkylidenedeoxybenzoin. On account of its behaviour on melting (it softens at 76° and is completely melted at 90°), it is regarded as a mixture of stereoisomerides of methylbenzylidenedeoxybenzoin, CPhMe:CPh·COPh, which could not be separated by crystallisation. Another part of the 2-pyrone compound decomposes thus:

$$(2)\ C_{23}H_{16}O_2 + 2KHO = CH_2Ph{\cdot}CPh{:}CH{\cdot}CO_2K + C_6H_5{\cdot}CO_2K$$

to form a mixture of isomeric β-benzylcinnamic acids, one of which could be obtained pure and melts at 168—169°. This acid, on reduction, yields β-phenyl-β-benzylpropionic acid (m. p. 95—96°), and with concentrated sulphuric acid condenses to 3-phenyl-1-naphthol,



$$C_6H_4{<}\begin{matrix}C(OH){:}CH \\ CH{=\!=}CPh\end{matrix}$$

(m. p. 100—101°).

70. "The solubility of organic acids and bases in solutions of their salts." (Preliminary note.) By Nevil Vincent Sidgwick.

Aniline is known to be more soluble in a solution of its hydrochloride than in pure water. An attempt was made to determine how far this property was shared by other bases, and by phenols and acids. *o*-Toluidine behaves in the same way as aniline; but the alkylamines examined (amylamine, diamylamine, and dipropylamine) appeared to be less soluble in the salt solution.

With phenols and monobasic acids an increase of solubility was found in every instance, whether they separated from the solution as liquids or as solids. The results are contained in the following table.

Substance.	Temperature.	Normality of salt.	Solubility in		Ratio.	*K.*
			Water.	Salt Solution.		
Aniline	25°	1	0·38	0·54	1·4*	$0·05 \times 10^{-8}$
	40°	1	0·42	0·65	1·5*	
	60°	1	0·50	0·81	1·6*	
	80°	1	0·61	1·07	1·7*	
o-Toluidine	25°	1	0·14	0·28	2·0	
Phenol	25°	1	0·85	—	—	50×10^{-8}
o-Cresol	25°	1	0·24	0·70	2·9*	
	40°	1	0·26	0·77	3·0*	
	60°	1	0·31	0·91	3·0*	
	80°	1	0·39	1·26	3·2*	
o-Nitrophenol	48°	1	0·028	0·069	2·4*	750×10^{-8}
Benzoic acid	25°	1	0·026	0·044	1·7	0·006
p-Toluic acid	25°	1	0·0031	0·0054	1·8	0·005
p-Nitrobenzoic acid	25°	1	0·0024	0·0046	1·9	0·040
Salicylic ,,	25°	1	0·016	0·036	2·3	0·102
Cinnamic ,,	25°	0·5	0·0041	0·0105	2·5	0·004
β-Phenylpropionic acid.	25°	1	0·050	1·15	22·9*	0·023
	11°	<1	0·032	0·051	1·6	
Hippuric ,,	25°	1	0·039	0·078	2·0	0·022
β-Iodopropionic ,,	25°	1	0·40	0·63	1·6	0·009

Those cases where the substance separates in the liquid form are marked with an asterisk.

The table gives the solubility (in terms of normality) of the substance in the salt solution and in pure water, the ratio of the first of these to the second, and the dissociation constant of the acid or base.

β-Phenylpropionic acid at 25° separates in a liquid form containing less than 50 per cent. of pure acid; at 11° the solid acid crystallises out, but some of the salt with it. Phenol is miscible in all proportions with a normal solution of its sodium salt at temperatures above 13°.

Where the substance separates as a liquid, the salt no doubt dissolves in both layers, and this may partly (and perhaps wholly in the case of the aromatic amines) explain the increase in solubility, since the mutual solubility of two liquids is always increased by the addition of a third substance, which dissolves more or less equally in both. Where the solid acid separates, this explanation cannot apply, and the phenomenon is probably due to the formation in the solution of a compound between the acid and the salt or its ions. This is confirmed by the numerous instances in which acid salts of monobasic acids, of the type $NaHA_2$, have been isolated in the solid state (see Farmer, *Trans.*, 1903, **83**, 1440).

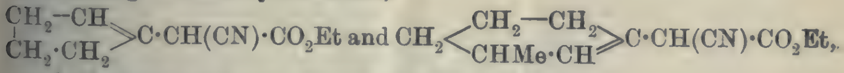
The work is being continued.

71. "1:4-Dichloroanthraquinone and its derivatives." By Gertrude Maud Walsh and Charles Weizmann.

An account was given of the condensation of 3:6-dichlorophthalic anhydride with benzene and with the methyl ethers of *o*-, *m*-, and *p*-cresol.

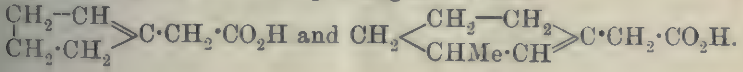
72. "The synthesis of Δ^1-*cyclo*penteneacetic acid and of 1-methyl-Δ^2-*cyclo*hexene-3-acetic acid." By Victor John Harding and Walter Norman Haworth.

The condensation of *cyclo*pentanone and 1-methyl*cyclo*hexan-3-one with ethyl cyanoacetate, either through the agency of sodium ethoxide or piperidine, gives rise to cyano-esters containing the ethylene linking in the ring. These cyano-esters,



$$\left.\begin{array}{l}CH_2{-}CH\\ CH_2{\cdot}CH_2\end{array}\right\gg C{\cdot}CH(CN){\cdot}CO_2Et \text{ and } CH_2\left<\begin{array}{l}CH_2{-}CH_2\\ CHMe{\cdot}CH\end{array}\right\gg C{\cdot}CH(CN){\cdot}CO_2Et,$$

on hydrolysis yield the corresponding acetic acids:



$$\left.\begin{array}{l}CH_2{-}CH\\ CH_2{\cdot}CH_2\end{array}\right\gg C{\cdot}CH_2{\cdot}CO_2H \text{ and } CH_2\left<\begin{array}{l}CH_2{-}CH_2\\ CHMe{\cdot}CH\end{array}\right\gg C{\cdot}CH_2{\cdot}CO_2H.$$

73. "Solubilities below and above the critical temperature."

By Dan Tyrer.

The solubilities of sodium iodide in ethyl alcohol and of potassium iodide in methyl alcohol have been measured from the ordinary temperature to about 300°. In both cases the solubility in the liquid solvent at first increases and then decreases. Just below the critical temperatures of the saturated solutions the solubility decreases very rapidly, the curve being almost parallel to the solubility axis. It is found that above the critical point the salts dissolve to quite moderate extents. The solubility above the critical point, however, depends on the concentration of the solvent, that is, the amount of solvent contained in unit-volume. The effect of temperature on the solubility in a solvent of a particular concentration is very slight, but is greatest for the greatest concentrations, and for small concentrations it becomes immeasurably small.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

American Electrochemical Society. Transactions. Vols. XII–XV. Philadelphia 1907–1909. (*Reference.*) From Dr. F. Mollwo Perkin.

Institute of Chemistry of Great Britain and Ireland. A list of official chemical appointments compiled, ... by *Richard B.* **Pilcher.** 3rd edition. pp. 234. London 1910. (*Recd.* 15/2/10.)
From the Institute.

Lowe, *Houston.* Paints for steel structures. pp. 115. New York 1910. (*Recd.* 21/1/10.)
From the Publishers: Messrs. John Wiley & Sons.

Passon, *Max.* Kleines Handwörterbuch der Agrikulturchemie. 2 vols. pp. iv + 454, 415. ill. Leipzig 1910. (*Recd.* 16/2/10.)
From the Publisher: Wilhelm Engelmann.

Sexton, *A. Humboldt.* Fuel and refractory materials. pp. x + 364. ill. London 1909. (*Recd.* 15/2/10.)
From the Publishers: Messrs. Blackie & Son.

Watson, *Richard.* Institutionum chemicarum in Prælectionibus Academicis explicatarum, Pars Metallurgica. pp. [viii] + 58. Cantabrigiæ 1768. (*Reference.*)
From Professor G. Carey Foster, LL.D., F.R.S.

II. *By Purchase.*

Rupe, *Hans.* Anleitung zum experimentieren in der Vorlesung über organische Chemie. pp. x + 130. ill. Braunschweig 1909. (*Recd.* 16/2/10.)

Thibaut, *P*[*ierre*]. The art of chymistry: As it is now practised. Written in French by *P.* **Thibaut**, Chymist to the French King. And now translated into English, by a Fellow of the Royal Society [W.A.]. pp. xxx + 279. London 1668. (*Reference.*)

III. *Pamphlets.*

Bredig, *Georg*, and **Kerb**, *J. W.* Über die elektrische Reizschwelle katalytischer Pulsationen. (From the *Verh. Naturhist. Med. Vereins Heidelberg*, 1909, **10**.)

Comessatti, *Giuseppe.* L'azione dello jodio e dei suoi composti sull' adrenalina. (From the *Arch. Farmacol. sper. Sci.ᵉ affini*, 1909, **8**).

Haensel, *Heinrich.* Bericht. April–September 1909. pp. 74. Pirna.

Hellsten, *A. F.* Der Einfluss des Trainierens auf die CO_2–Abgabe bei isometrischer Muskelarbeit. (From the *Skand. Archiv. Physiol.*, 1909, **22**.)

Kerp, *W.*, and **Wöhler**, *P.* Zur Kenntnis der gebundenen schwefligen Säuren. IV und V Abhandlung. (From the *Arb. Kais. Gesundheitsamte*, 1909, **32**.)

Kremann, *R.* Über die Fortexistenz von Doppelsalzen, im besonderen von Karnallit und Schönit in wässeriger Lösung. (From the *Jahrb. K. K. Geol. Reichsanstalt*, 1908, **58**.)

—— Beiträge zur Kenntnis isomorpher Mischungen. (From the *Jahrb. K. K. Geol. Reichsanstalt*, 1908, **58**.)

Kremann, *R.*, and **Hüttinger**, *K.* Über die Löslichkeit von Aluminiumhydroxyd in Aluminiumsulfatlösungen und zur künstlichen Darstellung von Alumian. (From the *Jahrb. K. K. Geol. Reichsanstalt*, 1908, **58**).

Lenormand, *C.* Détermination du degré de pollution des eaux de mer par le dosage des matières organiques. (From the *Bull. Soc. Pharm.*, 1909, **16**)

Mayerhofer, *Ernst.* Einiges zur Esbachschen quantitativen Eiweissbestimmung und über eine neue Kreatininverbindung. (From the *Wien. Klin. Woch.*, 1909, **22**.)

Mingaye, *J. C. H.* Notes from the Chemical Laboratory. No. 2. (From the *Records Geol. Sur. N. S. Wales*, 1909, **8**.)

Schimmel & Co. Bericht, Oktober 1909. pp. 236. Leipzig.

Széki, *Tibor*. Ueber einige anormale Eigenschaften des Asarylaldehyds. (From the *Naturw. Museumsheften*, 1909, **4**.)

Thunberg, *Torsten*. Studien über die Beeinflussung des Gasaustausches des überlebenden Froschmuskels durch verschiedene Stoffe. (From the *Skand. Archiv. Physiol.*, 1909, **22**.)

Walter, *L. H.* The metal tungsten as "valve" electrode. (From the *J. Proc. Inst. Elect. Eng.*, 1909, **43**.)

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held on Friday, March 18th, 1910, at 5 p.m., when the President will deliver his address, entitled, "The Union of Hydrogen and Oxygen in Flame."

At the next Ordinary Scientific Meeting on **Thursday**, March 17th, 1910, at **8.30** p.m., the following papers will be communicated:

"Organic derivatives of silicon. Part XIII. Optically active compounds containing one asymmetric silicon group." By F. Challenger and F. S. Kipping.

"Studies of dynamic isomerism. Part X. The relationship between absorption spectra and isomeric change. Absorption spectra of camphocarboxylic acid and its derivatives." By T. M. Lowry, C. H. Desch, and F. W. Southgate.

"Studies of dynamic isomerism. Part XI. The relationship between absorption spectra and isomeric change. Absorption spectra of the acyl derivatives of camphor." By T. M. Lowry and H. W. Southgate.

"The action of aromatic amines on malonic ester." By F. D. Chattaway and J. M. D. Olmsted.

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[*Issued* 30/3/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 369.

Thursday, March 17th, 1910, at 8.30 p.m., Professor Harold B. Dixon, M.A., F.R.S., President, in the Chair.

The President referred to the loss sustained by the Society in the death of Geheimrath Professor Dr. Hans Landolt (elected an Honorary and Foreign Member in 1888), and, on the same day, Monday, March 14th, of Professor James Campbell Brown, a Vice-President of the Society.

Messrs. A. L. Landau and N. V. Sidgwick were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

John Bethwaite, 48, Northumberland Street, Workington.
Harry Farrands, M.A., The College, Isleworth.
Charles Samuel Garland, 18, Derwent Grove, Dulwich, S.E.
Edwin Harrison, 18, Old Swan Lane, Upper Thames Street, E.C.
Horace George Mason, B.Sc., The Grammar School, Kingsbridge, South Devon.
Francis Edwin Needs, 7, Effingham Road, St. Andrew's Park, Bristol.

Of the following papers, those marked * were read:

***74. "Organic derivatives of silicon. Part XIII. Optically active compounds containing one asymmetric silicon group." By Frederick Challenger and Frederic Stanley Kipping.**

Experiments on the resolution of *dl*-dibenzylethylpropylsilicanemonosulphonic acid, $CH_2Ph \cdot SiEtPr \cdot CH_2 \cdot C_6H_4 \cdot SO_3H$ (Part XII, *Trans*

1910, **97**, 142), were described. Several bases were tried without success, but on systematically crystallising the brucine salt, extreme fractions differing in melting point by about 80° were obtained. These two fractions had the same specific rotations. The sparingly soluble one contained an acid which with *l*-menthylamine, cinchonidine, and strychnine gave compounds identical in melting point and specific rotation, within the limits of experimental error, with the corresponding salts of the *dl*-acid. Moderately concentrated solutions of the sodium salt of this resolution product seemed to be optically inactive.

In these circumstances additional evidence had to be procured before arriving at a definite conclusion, but in the end it was proved beyond all question that the acid had been resolved into its enantiomorphously related components.

The optically pure *l*-acid, prepared from the sparingly soluble brucine salt, has a specific rotation of about $[\alpha]_D$ $-0·75°$ in concentrated alcoholic solutions of its sodium salt. With all optically active bases which were examined, except, of course, with brucine, it gives salts which are almost indistinguishable by melting point or specific rotation determinations from the corresponding derivatives of the *dl*-acid.

These results are very similar to those previously obtained in the case of the active and *dl*-sulphobenzylethylpropylsilicyl oxides, which contain two asymmetric silicon groups (Kipping, *Trans.*, 1907, **91**, 234; 1908, **93**, 465), but in the present instance the enantiomorphous character of the active acid is even more rarely exhibited.

*75. "The rate of hydration of acetic anhydride."

By Albert Cherbury David Rivett and Nevil Vincent Sidgwick.

The authors have determined the velocity of the above reaction in water at 25° by means of the conductivity. The conductivity and viscosity of solutions of acetic acid from $3N$ downwards were measured, and it was shown that if the ionic velocity is assumed to be proportional to the fluidity (the reciprocal of the viscosity), Ostwald's law holds for this acid up to a normality of 0·94, whereas in its simple form it does so only up to 0·05.

The velocity of hydration of the anhydride showed that the reaction was a unimolecular one. It is not catalysed by hydrogen ions, and beyond a certain point the constant falls steadily with increasing concentration.

*76. "The colour and ionisation of cupric salts. Part II." By Nevil Vincent Sidgwick and Henry Thomas Tizard.

In continuation of previous work (*Trans.*, 1908, 93, 187), the authors have redetermined the depth of colour of cupric acetate, propionate, and formate in water, and the influence of acid on it. Excess of acid markedly diminishes the colour in the acetate and propionate, the diminution reaching a limit when about one equivalent of acid has been added; further addition has no effect. No change is produced with the formate. This points to the existence of hydrolysis, the product of which has in the first two cases a deeper colour than the salt. The fall in (molecular) colour on adding excess of acid is constant, and independent of the dilution.

The conductivity and viscosity of solutions of these three salts, (1) neutral, (2) in presence of one equivalent, (3) in presence of two equivalents of the acid, have also been measured. In strong solutions of the acetate or propionate, the second equivalent diminishes the conductivity, owing no doubt to the increase of viscosity. Assuming ionic velocity to be proportional to fluidity, then if μ_0, μ_1, μ_2 are the molecular conductivities, and η_0, η_1, η_2 the viscosities of the three solutions at any concentration, $M = \mu_1\eta_1 - (\mu_2\eta_2 - \mu_1\eta_1)$ is the corrected conductivity of a neutral solution in which no hydrolysis should occur. The difference $H = M - \mu_0\eta_0$ is the change of conductivity due to the hydrolysis. H was found to be very nearly constant. It increases slightly with dilution, but much less than M, which appears to indicate the improbable conclusion that the hydrolysis diminishes with increasing dilution.

If the only dissociation taking place over the range examined is $CuA_2 \rightleftarrows CuA^{\cdot} + A'$, and the colour of CuA_2 and $CuA^{\cdot}$ is constant, and if M is proportional to the degree of ionisation, then on plotting the colour against M, a straight line should be obtained. As a fact, however, the rise of colour at high concentrations is greater than this. Possible causes of this disagreement were discussed.

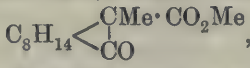
From the values of M, those of the velocities of the $CuA^{\cdot}$ ion and of K, the dissociation constant of the salt, have been calculated. The agreement in K at not too great dilutions is good, but the ionic velocities are unexpectedly high.

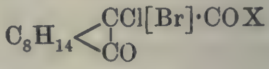
*77. "Some new metallic carbonyls." By the late Ludwig Mond, Heinrich Hirtz, and Matthewman Dalton Cowap.

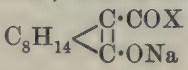
A description was given of a new *cobalt carbonyl*, $Co(CO)_3$, which is obtained by the action of heat on the carbonyl $Co(CO)_4$. *Molybdenum carbonyl*, $Mo(CO)_6$, and a *ruthenium carbonyl* have also been prepared.

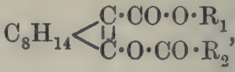
*78. "Studies of dynamic isomerism. Part X. The relationship between absorption spectra and isomeric change. Absorption spectra of camphorcarboxylic acid and its derivatives." By Thomas Martin Lowry, Cecil Henry Desch, and Herbert William Southgate.

Four types of absorption curve were described:

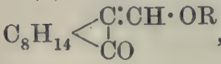
(1) Camphorcarboxylic acid, its sodium salt, esters, amide, and piperidide give a shallow band at 1/λ 3450. This band is also given by the dimethyl derivative,  $C_8H_{14}<\begin{array}{l}CMe\cdot CO_2Me\\ \vert\\ CO\end{array}$, and is attributed to the carbonyl group. The diethyl derivative is abnormal, and appears to be differently constituted.

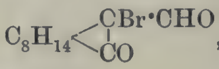
(2) The halogen derivatives,  $C_8H_{14}<\begin{array}{l}CCl[Br]\cdot COX\\ \vert\\ CO\end{array}$, give continuous absorption curves, but with a well-marked extension near the point where the bands appear in the spectra of the parent substances.

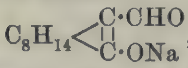
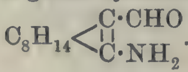
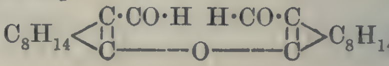
(3) In presence of alkalis the esters and amide give a deep band at 1/λ 3450; this is attributed to the formation of an enolic sodium salt,  $C_8H_{14}<\begin{array}{l}C\cdot COX\\ \Vert\\ C\cdot ONa\end{array}$.

(4) The enolic acyl derivatives,  $C_8H_{14}<\begin{array}{l}C\cdot CO\cdot O\cdot R_1\\ \Vert\\ C\cdot O\cdot CO\cdot R_2\end{array}$, give continuous absorption curves.

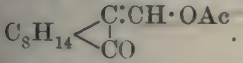
*79. "Studies of dynamic isomerism. Part XI. The relationship between absorption spectra and isomeric change. Absorption spectra of the acyl derivatives of camphor." By Thomas Martin Lowry and Herbert William Southgate.

(1) Oxymethylenecamphor and its methyl and ethyl esters,  $C_8H_{14}<\begin{array}{l}C{:}CH\cdot OR\\ \vert\\ CO\end{array}$, give a deep band at 1/λ 3800.

(2) The bromo-derivative,  $C_8H_{14}<\begin{array}{l}CBr\cdot CHO\\ \vert\\ CO\end{array}$, gives a continuous curve with a well-marked extension.

(3) The sodium salt,  $C_8H_{14}<\begin{array}{l}C\cdot CHO\\ \Vert\\ C\cdot ONa\end{array}$, gives a deep band at 1/λ 3350. The same band is given by aminomethylenecamphor, which is therefore formulated as  $C_8H_{14}<\begin{array}{l}C\cdot CHO\\ \Vert\\ C\cdot NH_2\end{array}$. The anhydride gives a band at 1/λ 3500, and is probably  $C_8H_{14}<\begin{array}{l}C\cdot CO\cdot H\quad H\cdot CO\cdot C\\ \Vert\qquad\qquad\qquad\quad\ \Vert\\ C\text{———}O\text{———}C\end{array}>C_8H_{14}$, whilst the

acetyl derivative, which gives a band at 1/λ 4000, is perhaps



$$C_8H_{14}<\begin{matrix}C{:}CH\cdot OAc \\ | \\ CO\end{matrix}.$$

(4) Acetyl-, propionyl-, and butyryl-camphor give a band at 1/λ 3550; on the addition of sodium hydroxide, a deep band is developed at 1/λ 3250.

(5) Benzoylcamphor (enolic form) gives a band at 1/λ 3250; this is moved to 1/λ 3150 in the sodium salt, and to 1/λ 3500 in the acetyl and benzoyl derivatives.

80. "The action of aromatic amines on ethyl malonate." By Frederick Daniel Chattaway and James Montrose Duncan Olmsted.

The statements hitherto made respecting this reaction leave the impression that the esters of malonanilic and malonotoluidic acids are only to be obtained with difficulty, and that they are not formed by the interaction of malonic ester and aromatic amines.

The recent work of Chattaway and Mason (*Trans.*, 1910, **97**, 339) has shown that the interaction of malonic ester and halogen-substituted anilines follows a perfectly regular course, and that both halogen-substituted ethyl malonanilates and malonanilides are formed.

The authors find that unsubstituted aromatic amines act similarly. When aniline or a toluidine is heated with ethyl malonate, the ester of malonanilic or the corresponding malonotoluidic acid is first formed, this being converted into malonanilide or a malonotoluidide by the further action of the amine. As the corresponding acids can be obtained in nearly theoretical amounts by hydrolysing the esters, this is by far the simplest method of preparing them.

81. "Synthesis of dipeptides of lauric and *n*-nonoic acids. Products of the condensation of lauric and *n*-nonoic acids with glycine, alanine, and leucine." (Preliminary note.) By Arthur Hopwood and Charles Weizmann.

During the course of some experiments on the synthesis of substances of possible physiological importance, the authors have prepared the following:

*a-Bromo-*n*-nonoyl chloride*, $C_8H_{16}Br\cdot COCl$, prepared by heating a-bromononoic acid and phosphorus pentachloride, boils at 118—120°/9 mm.

*a-Bromo-*n*-nonoylglycine*, $C_8H_{16}Br\cdot CO\cdot NH\cdot CH_2\cdot CO_2H$, prepared by the interaction of a-bromononoyl chloride and glycine in alkaline solution, is crystalline and melts at 116°.

a-Amino-n-nonoylglycine, $NH_2\cdot C_8H_{16}\cdot CO\cdot NH\cdot CH_2\cdot CO_2H$, prepared from α-bromononoylglycine and concentrated aqueous ammonia, melts at 215—216°.

A similar series of compounds has been obtained by the condensation of α-bromo-*n*-nonoyl chloride with alanine and with leucine; also from *n*-lauric acid by the interaction of α-bromo-*n*-lauryl chloride and glycine, alanine, and leucine respectively.

82. "The densities and molecular weights of neon and helium." By Herbert Edmeston Watson.

A considerable quantity of neon has been prepared in a high state of purity, the separation from helium having been effected by a fractionation from charcoal at the temperature of liquid air.

The weight of a normal litre of this gas was found to be 0·9002 gram, this being the mean of eleven determinations, and the error should not exceed 0·0003. The value originally found by Ramsay and Travers was 0·891.

The density of helium was also measured, the figure 0·1782 being obtained, but as this was the mean of only two determinations with the same sample of gas, it should not be considered correct to more than 1 part in 500.

Some experiments were carried out on the rate of diffusion of a mixture of neon and helium through quartz, with the view of effecting a separation by this means. It was found, however, that quartz is slightly permeable to neon, and, moreover, that the rate of diffusion of helium was far smaller than had been expected.

An estimate of the amounts of helium and neon in the atmosphere gave the values 1 part by volume in 185,000 and 1 in 55,000 respectively.

In conjunction with Mr. F. P. Burt, the author has calculated, according to Berthelot's method, the molecular weights of these gases, using the figures obtained by Burt for the compressibility of helium and neon at 0° (*Trans. Faraday Soc.*, 1910, **6**, Pt. I.) and the above values for the densities. The molecular weight of helium is thus found to be 3·994, and of neon, 20·200.

83. "The molecular weights of krypton and xenon." By Herbert Edmeston Watson.

The densities of krypton and xenon were recently determined by Moore (*Trans.*, 1908, **93**, 2181), but in deducing the molecular weights, no correction was applied for compressibility, although with these gases this correction may amount to a considerable quantity.

The compressibility has now been calculated from the critical constants by Guye's method (*J. Chim. Phys.*, 1905, 5, 5), and the figures obtained were compared with those deduced from the compressibility measurements of Ramsay and Travers (*Proc. Roy. Soc.*, 1901, 67, 329). As these were carried out only at pressures exceeding 25 atmospheres, there is naturally a considerable amount of uncertainty in the results, but, nevertheless, the agreement is as good as can be expected.

The results obtained, as well as the corresponding figures for the other inactive gases, are summarised in the following table, L being the weight of a normal litre, and A the compressibility coefficient between 0 and 1 atmosphere :

	L (grams).	$A \times 10^5$.	Mol. wt.
Helium	0·1782	0	3·994
Neon	0·9002	105	20·200
Argon	1·7809	− 93	39·881
Krypton	3·708	− 215	82·92
Xenon.................	5·851	− 690	130·22

84. "Studies in the diphenyl series. Part I. Acetylation of benzidine derivatives." By John Cannell Cain and Percy May.

The authors have studied the acetylation, by means of acetic anhydride in aqueous-alcoholic solution, of several bases of the benzidine series, and have determined the relative proportions of mono- and di-acetyl derivatives formed.

The presence of negative groups in all cases diminishes the degree of acetylation, and it was suggested that this influence of negative groups (which of course is well known) may be due to the existence of a double linking between the negative atom or group and the nitrogen atom.

Several new mono- and di-acetyl derivatives of substituted benzidines were described.

85. "Additive compounds of *s*-trinitrobenzene with arylamines. Combination as affected by the constitution of the arylamine." By John Joseph Sudborough and Stanley Hoskings Beard.

A description was given of additive compounds prepared from *s*-trinitrobenzene and a number of aromatic amines, and the relationship between the constitution of the amine and (*a*) its capacity to form an additive compound, (*b*) the colour of the additive compound, was discussed.

BANQUET TO PAST PRESIDENTS.

The Banquet to Past Presidents will be held at the Savoy Hotel, on Thursday, May 26th, 1910.

Further particulars will be announced shortly.

At the next Ordinary Scientific Meeting on **Thursday**, April 21st, 1910, at **8.30** p.m., the following papers will be communicated:

"Tetranitroaniline." By B. Flürscheim and T. Simon.

"Experiments on the Walden inversion. Part IV. The interconversion of the optically active atrolactinic acids." By A. McKenzie and G. W. Clough.

"Studies in fermentation. Part III. The rôle of diffusion in fermentation by yeast cells." By A. Slator and H. J. S. Sand.

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PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 370.

Friday, March 18th, 1910, at 5 p.m., Annual General Meeting, Professor HAROLD B. DIXON, M.A., F.R.S., President, in the Chair.

Mr. J. S. S. BRAME and Dr. N. V. SIDGWICK were appointed Scrutators, and the ballot was opened for the election of Officers and Council for the ensuing year.

The Report of the Council on the progress of the Society during the past twelve months was presented by the PRESIDENT, and the Treasurer, after making a statement as to the Society's income and expenditure for 1909, proposed a vote of thanks to the Auditors, which was seconded by Mr. A. C. CHAPMAN and acknowledged by Dr. J. A. VOELCKER.

The adoption of the Report of Council together with the Balance Sheet and Statements of Accounts for the year ended December 31st, 1909, proposed by Dr. G. McGOWAN and seconded by Dr. H. BRERETON BAKER, was put to the Meeting and carried unanimously.

REPORT OF THE COUNCIL.

The Council is again in a position to report favourably on the progress of the Society, as indicated by an increase in the number of Fellows and in the list of papers communicated.

On the 31st December, 1908, the number of Fellows was 2,950. During 1909, 160 Fellows have been elected and 7 were reinstated, the gross total thus being 3,117. The Society has lost 25 Fellows by death; 43 have resigned; the election of 2 Fellows has become void, and 44 Fellows have had their names removed from the List for non-payment of Annual Subscriptions.

The total number of Fellows, therefore, at the 31st December, 1909, was 3,003, showing a net increase of 53 over the preceding year.

The names of the deceased Fellows, with the dates of their election, are:

R. Bannister (1871).
J. Castell-Evans (1903).
E. J. Cox (1886).
C. B. Dudley (1898).
C. Ekin (1864).
J. Fuller (1886).
C. Graham (1862).
H. E. Harrison (1883).
W. H. Hudleston (1871).
S. H. Johnson (1866).
J. J. Kielty (1903).
L. Mond (1872).
F. Norton (1854).
G. E. Perry (1888).
E. A. Pontifex (1848).
T. H. Redwood (1887).
W. B. Roberts (1880).
W. J. Russell (1851).
W. Stewart (1872).
F. Stocks (1874).
C. Thomas (1871).
H. E. Thomas (1874).
Sir T. Wardle (1875).
A. F. Watson (1893).
J. H. Wilson (1878).

The following Fellows have resigned

E. W. Bealey.
H. J. Brown.
T. S. Busher.
E. Catherall.
E. Cleminshaw.
A. J. Cook.
J. W. Daniels.
J. H. Davidson.
F. R. Dudderidge.
E. J. Fairhall.
C. Gordon.
J. H. Gough.
H. W. Harrie.
J. W. Helps.
C. P. Hines.
E. Houghton.
A. Howard.
R. S. Hutton.
A. J. Hyder.
A. James.
W. H. M. Jones.
J. Leicester.
A. G. Levy.
R. D. MacKechnie.
W. Mackean.
A. McMullen.
C. A. MacMunn.
*C. Müller.
J. M. Murray.
P. G. Pennymore.
H. Richardson.
H. E. Richardson.
J. Richardson.
*C. J. Smith.
T. Southern.
W. S. Templeton.
R. Tervet.
A. Tighe.
S. Tolson.
A. J. Webb.
G. H. West.
F. G. Wiechmann.

and Professor Dr. Georg Lunge, whose name has been transferred from the list of Fellows to that of the Honorary and Foreign Members.

The number of those Fellows elected previous to the year 1860 has been diminished still further by the death of Mr. Fletcher Norton, elected on December 18th, 1854, of Mr. Edmund Alfred Pontifex, elected December 4th, 1848, and of our distinguished Past-President, Dr. William James Russell, F.R.S., elected March 3rd, 1851.

The number of Honorary and Foreign Members at the close of

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* Included among the seven reinstated Fellows.

1909 was 34. One election has taken place, and the Society has to mourn the loss of Professor Emil Erlenmeyer, and of Professor Julius Thomsen, who passed away early last year, making the total number of Honorary and Foreign Members at December 31st, 1909, amount to 33.

The Council has much pleasure in congratulating the following gentlemen, who, during the past year, have reached their Jubilee as Fellows of the Society:

Prof. Dr. Heinrich Debus, F.R.S.
Mr. Thomas Fogg.
Dr. A. G. Vernon Harcourt, F.R.S.
Mr. Josiah W. Kynaston.
Dr. Hugo Müller, F.R.S.
Mr. Thomas W. Salter.
Mr. John Spiller.

During the year 1909, 300 scientific communications have been made to the Society, 227 of which have been published already in the Transactions, and abstracts of all have appeared in the Proceedings.

The volume of Transactions for 1909 contains 2,219 pages, of which 2,133 are occupied by 236 memoirs, the remaining 86 pages being devoted to the Obituary Notices, the Wolcott Gibbs and Mendeléeff Memorial Lectures, the Report of the International Committee on Atomic Weights, the Report of the Annual General Meeting, and the Presidential Address; the volume for the preceding year contains 222 memoirs, which occupy 2,188 pages.

The Journal for 1909 contains 4,946 abstracts, which extend to 2,040 pages, whilst the abstracts for 1908 numbered 4,978, and occupied 2,112 pages. The abstracts for 1909 may be classified as follows:

	Pages.	No. of Abstracts
PART I.		
Organic Chemistry	980	1,781
PART II.		
General and Physical Chemistry		953
Inorganic Chemistry		565
Mineralogical Chemistry		144
Physiological Chemistry		577
Chemistry of Vegetable Physiology and Agriculture		304
Analytical Chemistry		622
	1,060	3,165
Total in Parts I. and II.	2,040	4,946

Since the last Annual General Meeting, three Memorial Lectures, dealing with the life-work of deceased Honorary and Foreign Members have been delivered. On the 3rd of June, 1909, Dr. Frank Wigglesworth Clarke paid this tribute to the late Professor Wolcott Gibbs; Sir William Tilden delivered the Mendeléeff Memorial Lecture on October 21st, and Sir Edward Thorpe reviewed the thermochemical and other researches of Professor Julius Thomsen in a discourse given before the Society on February 17th, 1910.

The year 1911 marking the hundredth anniversary of Avogadro's celebrated memoir, the Council has voted a contribution of £10 from the funds of the Society towards the international commemoration of the event. Fellows have been invited also to participate in the celebration of Professor Körner's seventieth birthday, which will be recognised on behalf of the Society by the presentation of an illuminated address of congratulation in May next.

The rapid growth of the Library since the contents of the rooms at Burlington House were valued, has necessitated the preparation of a fresh estimate of replacement cost; this has now been completed, and an arrangement based thereon will be concluded with the Insurance Company.

During the past year the Chemical Society has become indebted to the Society of Dyers and Colourists for the gift of a reproduction in bronze of the plaque by Mr. F. W. Pomeroy, R.A., representing the late Sir William Perkin. Professor Meldola has added to the collection of photographs an interesting one of the Jury (Paris Exhibition, 1900), which included among its members the late Professor Mendeléeff, and the Society has also received valuable gifts of books from Mrs. J. Wilson, Mr. A. Gamble, and Mr. F. Stocks.

In chronological order, Past-Presidents the Rt. Hon. Sir Henry Roscoe, Sir William Crookes, Dr. Hugo Müller, and Dr. A. G. Vernon Harcourt have more than completed fifty years of Fellowship, whilst Professor William Odling, who has now been for sixty-two years a Fellow, and became President in 1873, is the sole survivor of the six Past-Presidents who were entertained to a banquet in 1898. Desiring to do honour to these gentlemen in the name of the Society, the Council, through the President, has invited them to a banquet to be held during the ensuing summer, believing that a considerable number of Fellows will be glad to assist at this interesting commemoration, details of which will be announced forthwith.

With the object of meeting a widely expressed desire, the Report of the International Committee on Atomic Weights will in future, it is hoped, be published in September instead of in January. This will render it immediately useful to College teachers at the beginning of each new Session. In order to adapt the list of amended Atomic

Weights to the requirements of students, it is now printed on paper as well as on cardboard.

The Council desires to place on record its high appreciation of the valuable services rendered to the Society by Dr. M. O. Forster, who now retires from the position of Honorary Secretary, which he has held for the last six years. Dr. Forster has given unsparingly both his time and his energy to the work of the Society, and has ever been active in promoting its highest interests.

The number of books borrowed from the Library during the year 1909 was 1,548, as against 1,339 in the previous year; of these, 347 were issued by post, as against 338 in the preceding year.

The additions to the Library comprise: 142 books, of which 72 were presented, 418 volumes of periodicals (representing 243 journals), and 80 pamphlets, as against 159 books, 412 volumes of periodicals (representing 245 journals), and 36 pamphlets last year.

The income of the Society for the year shows an increase of £252 10*s.* 10*d.* over that of last year, the amounts being £7,387 8*s.* and £7,134 17*s.* 2*d.* respectively, whilst the expenditure has risen from £6,834 15*s.* to £7,028 3*s.* 5*d.* This leaves in the Treasurer's hands a balance of £359 4*s.* 7*d.* on the year's working, which together with the balance of £300 saved in 1908 has enabled the Council to authorise the purchase of £700 Canadian 3½ per cent. stock.

In the balance-sheet for this year there appears for the first time a valuation of the Library, Furniture, Bronzes, Busts, &c. This has been based on a complete inventory which has now been made in order to be used as the basis for the new Fire Insurance Policy which will be arranged in June next, when the present policy expires.

Thanks to the care of the Publication Committee and the Editor, the net cost of the annual publications (taking account of their increased sales) only shows a rise of about £25, and this, be it noted, includes the preparation for the next volume of the Decennial Indexes which is now fairly under way. The cost of indexing no longer appears as a separate item in our accounts, as it has been entirely taken over by the Editor and is included in his salary. There has been a reduction of nearly £100 in the cost of the Annual Reports, whilst house expenses and repairs cost about £50 less than last year. The chief items in the expenditure which are not of annual occurrence are the new cases for the Library costing £93 10*s.*, and the balance of the Dinner account, which was no less than £70 9*s.* 6*d.*

From the Research Fund grants were made amounting in all to £369, and as this year there was the further outlay on the Longstaff Medal and its accompanying Honorarium, the expenditure exceeded the income by £34 17*s.* 1*d.*, this deficit being met from the balance in hand. During the last six years grants have been made to 183 out of 216 applicants, the total amount applied for having been £2,845, of which £1,673 was granted, and of this £57 has been refunded. In return, 160 papers have appeared in our Transactions, 18 in the Proceedings, and 22 in other journals.

A vote of thanks to the Treasurer, Honorary Secretaries, Foreign Secretary, and Council for their service during the past year was proposed by Dr. BERNARD DYER, seconded by Mr. E. GRANT HOOPER, and acknowledged by Dr. M. O. FORSTER, the retiring Hon. Secretary.

The PRESIDENT then delivered his address, entitled "The Union of Hydrogen and Oxygen in Flame." Dr. A. G. VERNON HARCOURT proposed a vote of thanks to the President coupled with the request that he would allow his address to be printed in the Transactions. The motion was seconded by Sir EDWARD THORPE and carried with acclamation, and acknowledged by the PRESIDENT.

The Scrutators having presented their report, the PRESIDENT declared that the following had been elected as Officers and Council for the ensuing year:

President: Harold B. Dixon, M.A., F.R.S.

Vice-Presidents who have filled the Office of President: H. E. Armstrong, Ph.D., LL.D., F.R.S.; A. Crum Brown, D.Sc., LL.D., F.R.S.; Sir William Crookes, D.Sc., F.R.S.; Sir James Dewar, M.A., LL.D., F.R.S.; A. Vernon Harcourt, M.A., D.C.L., F.R.S.; Raphael Meldola, F.R.S.; H. Müller, Ph.D., LL.D., F.R.S.; W. Odling, M.A., M.B., F.R.S.; Sir William Ramsay, K.C.B., LL.D., F.R.S.,; J. Emerson Reynolds, Sc.D., M.D., F.R.S.; The Rt. Hon Sir Henry E. Roscoe, LL.D., F.R.S.; Sir Edward Thorpe, C.B., LL.D., F.R.S.; Sir William A. Tilden, D.Sc., F.R.S.

Vice-Presidents: J. Norman Collie, Ph.D., F.R.S.; J. J. Dobbie, M.A., D.Sc., F.R.S.; M. O. Forster, D.Sc., Ph.D., F.R.S.; F. Stanley Kipping, D.Sc., Ph.D., F.R.S.; A. Liversidge, LL.D., F.R.S.; J. Walker, D.Sc., Ph.D., F.R.S.

Treasurer: Alexander Scott, M.A., D.Sc., F.R.S.

Secretaries: A. W. Crossley, D.Sc., Ph.D., F.R.S.; G. T. Morgan, D.Sc.

Foreign Secretary: Horace T. Brown, LL.D., F.R.S.

Ordinary Members of Council: Julian L. Baker; George T. Beilby, F.R.S.; William A. Bone, D.Sc., Ph.D., F.R.S.; Adrian J. Brown, M.Sc.; Julius B. Cohen, Ph.D., B.Sc.; Charles E. Groves, F.R.S.; J. T. Hewitt, M.A., D.Sc., Ph.D.; H. R. Le Sueur, D.Sc.; Alex. McKenzie, D.Sc., Ph.D.; J. C. Philip, D.Sc., Ph.D.; Sir Boverton Redwood, D.Sc.; A. E. H. Tutton, M.A., D.Sc., F.R.S.

Thursday, April 21st, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., F.R.S., President, in the Chair.

It was announced that the Council had appointed the following Committees for 1910–1911:

Finance Committee: Messrs. E. G. Hooper, G. T. Moody, Sir Edward Thorpe, Sir William A. Tilden, and the Officers.

House Committee: Messrs. W. R. Dunstan, R. Messel, J. E. Reynolds, J. M. Thomson, Sir Edward Thorpe, Sir William A. Tilden, and the Officers.

Library Committee: Messrs. E. C. C. Baly, B. Dyer, W. Gowland, A. Harden, C. A. Keane, R. Meldola, E. J. Mills, J. M. Thomson (Chairman), Sir William A. Tilden, J. A. Voelcker, J. Wade, The Editor, and the Officers.

Publicatio Committee: Messrs. M. O. Forster, C. E. Groves, J. T. Hewitt, A. McKenzie, R. Meldola, Sir William Ramsay, Sir Edward Thorpe, and the Officers.

Research Fund Committee: Messrs. H. B. Baker, G. T. Beilby, J. N. Collie, A. D. Hall, A. Liversidge, R. Meldola, R. Messel, Sir Alexander Pedler, W. J. Pope, J. E. Reynolds, and the Officers.

The President stated that on the occasion of the Celebration of Professor Körner's Seventieth Birthday, to be held on May 15th, 1910, the following congratulatory Address would be presented on behalf of the Society:

PROFESSOR WILHELM KÖRNER:

The President, Officers, and Council of the Chemical Society gladly take advantage of the opportunity afforded by your Seventieth Birthday to offer you the felicitations of English Chemists on the occasion.

It is now so usual to consider the constitution of benzene as established, that few are mindful of the times when the study of the immediate derivatives of the hydrocarbon was regarded by Chemists as of the first importance. In those days, you were the most active of the pioneer workers. It is universally known that the all-significant hexagon formula is the product of the genius of Kekulé, but some Chemists need to be reminded that yours were the hands which furnished the larger part of the experimental material required to give logical precision and practical value to Kekulé's conception.

Gifted with unusual experimental skill, while Assistant to Kekulé in Ghent, you prepared a remarkably beautiful series of derivatives of benzene, which were shown at the Exhibition of 1867 in Paris; for this collection, on the recommendation of your patron Stas and at the instigation of Dumas, you received special recognition from the hands of the late Emperor of the French.

The results of your labours were ultimately described in a comprehensive Italian monograph published in 1874; they were made known to English Chemists early in 1876, in an abstract of record length published in the Journal of our Society. In this memoir, you developed the method of determining the position of the radicles in the derivatives of benzene, by reference to certain simple di-derivatives, which has since been the accepted method. The Society that once numbered Faraday, the discoverer of benzene, among its Fellows, has peculiar pleasure in acknowledging the very special value of your work.

Signed on behalf of the Chemical Society,
(*Signed*) HAROLD B. DIXON, *President.*
ALEXANDER SCOTT, *Treasurer.*
M. O. FORSTER, ⎧ *Honorary*
ARTHUR W. CROSSLEY, ⎩ *Secretaries.*
HORACE T. BROWN, *Foreign Secretary.*

Dated this Eighteenth Day of March, One Thousand, Nine Hundred and Ten.

Certificates were read for the first time in favour of Messrs.:

Geoffrey Alfred Bracewell, 20, Heaton Grove, Bradford.
Alexander Scott Dodd, B.Sc., 173, Bruntsfield Place, Edinburgh.
James Grieve, 127, Buchanan Street, Glasgow.
John Haycock, Great Glen, nr. Leicester.
John Huck, M.A., The Foundation, St. Bees School, Cumberland.
Edward Talbot Paris, 15, Montpellier Villas, Cheltenham.
Roland Edgar Slade, M.Sc., Muspratt Laboratory, The University, Liverpool.
James Harry Smith, 5, Turks Road, Radcliffe, Lancs.
Thomas May Smith, "Walla Crag," Osborne Road, Romford.
Ferdinand Bernard Thole, B.Sc., 23, Cowper Avenue, East Ham, E.
Frederick George Williams, 5, Mayhill Road, Charlton, S.E.

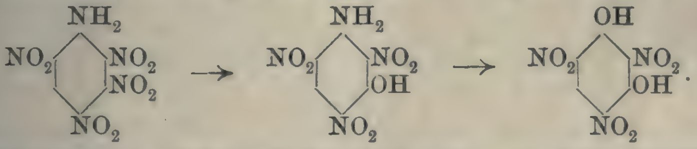
Of the following papers, those marked * were read :

*86. "Tetranitroaniline."

By Bernhard Flürscheim and Theodor Simon.

When *m*-nitroaniline, 2 : 3-dinitroaniline, 3 : 4-dinitroaniline, or some of their derivatives are nitrated, a good yield of a tetranitroaniline is obtained, the yield being about two-thirds of the theoretical.

Tetranitroaniline separates from acetic acid in yellow crystals, melting and decomposing at 212°. The meta-nitro-group is quantitatively and instantaneously removed by sodium acetate in aqueous acetone solution at the ordinary temperature, a trinitroaminophenol, melting at 174—175°, being formed. Since the latter is converted into trinitroresorcinol by boiling with aqueous potassium hydroxide, the constitution and changes are expressed by the formulæ :



Other reagents, such as hydrochloric acid or sodium chloride in aqueous acetone solution, boiling aqueous sodium acetate or bicarbonate, phenol, etc., also remove the nitro-group in the 3-position. Tetranitroacetanilide is similarly transformed into trinitroacetylaminophenol, which can also be obtained from trinitroaminophenol by partial hydrolysis of its diacetyl derivative.

Preliminary experiments have also shown that when 3 : 5-dinitroaniline is similarly nitrated, a nitroamine is first formed, which is subsequently converted into a compound which may be pentanitroaniline.

Discussion.

Dr. Morgan said that Mr. Clayton and he had noticed that when dimethyl-*p*-toluidine, dissolved in concentrated sulphuric acid, was treated with excess of nitro-sulphuric acid, 2-nitrodimethyl-*p*-toluidine was obtained, but on pouring the product into water at 30° the diluted nitric acid produced further nitration to dinitrodimethyl-*p*-toluidine. This result corresponded with Dr. Flürscheim's observations on the nitration of *m*-nitroaniline and its derivatives with nitric acid of varying strengths, and it would be of interest to know whether the author had any explanation to offer of the singular fact that the weaker acid was the more efficient nitrating agent.

Replying to the President's question as to the sensitiveness of the meta-nitro-group, Dr. Flürscheim said that, according to Blanksma, tetranitrophenol also loses a nitro-group when boiled with water, but that the reaction of tetranitroaniline with neutral salts, at the ordinary temperature, had not been observed with tetranitrophenol. In connexion with the reaction mentioned by Dr. Morgan, no explanation was offered why a second nitro-group should enter the meta-position with regard to the amino-group more readily than did the first nitro-group. In reply to Dr. Forster's suggestion, Dr. Flürscheim stated that no attempt had been made to diazotise amines by means of the reactive nitro-group of tetranitroaniline, but that, in view of the reaction with phenol, it would probably be possible to do so.

*87. "A method for the approximate estimation of small quantities of lead." By A. G. Vernon Harcourt

A quick approximate test of the amount of sulphur in coal gas was brought into use by the author many years ago. The gas, in which the sulphur was present as hydrogen sulphide, was led through an alkaline solution of lead, mixed with syrup, until the brown colour matched a standard. Having recently to arrange for the estimation of very small quantities of lead which are breathed in as dust by some of the workers in potteries, he has reversed the above process, and estimated the amount of lead by comparing with a set of standards the coloration caused by an excess of hydrogen sulphide. Since the liquid coloured by lead sulphide fades gradually in daylight, standards the colour of which is fast are made by mixing the sulphates of copper, cobalt, and ferric iron, and diluting the mixture to match the colours given in a volume of 50 c.c. by quantities of lead varying progressively from 0·5 to 25 centimilligrams. Such dilute solutions are not coloured on addition of hydrogen sulphide in presence of even a small excess of the nitric acid used for their extraction, but a brown tint, paler or deeper according to the quantity of lead, appears on further addition of sodium acetate. To prevent precipitation of lead sulphide there must be sugar in the liquid and but little agitation.

The estimations are made by placing the cylinder, in which the lead sulphide has been formed, on a sheet of white paper between the standards—consisting of the same volume of liquid sealed up in similar cylinders—which it most resembles, and comparing the depth of colour of the disks which form the upper surfaces of the liquids. If, for example, the lead sample is rather darker than "7," but not so dark as "10," the conclusion is that the amount of lead present is more than 7, but less than 10, centimilligrams. The total volume of dilute acid used to extract lead from a weighed amount of dust or frit or glaze being known, and also the volume of the part taken for testing, the percentage of lead, or lead oxide, dissolved from the sample is calculated.

Discussion.

Dr. Veley remarked that as a solution coloured by lead sulphide could be matched against a solution made up of coloured sulphates of certain metals, the sulphide must be in a state of so-called pseudo-solution, or, what might be the same thing, in a colloidal condition. The experience of Dr. Harcourt that gentle stirring produced uniformity in the solution, but that violent agitation caused a distinct sediment or precipitate, appeared to favour this view. Dr. Harcourt's observations accorded with his own, the result of many hundreds of colour observations, that daylight from a north window was, on the whole, the most uniform illuminant, although for matching clear-coloured solutions, a gas flame with mantle was less satisfactory.

It was desirable again to point out that in all tintometer experiments the personal error was of a twofold character, namely, first, that of one person with another, and, secondly, that of one person with himself according to his state of health. The error from the latter was often greater than that from the former.

The President asked whether the author had detected lead in the dust of the atmosphere of pottery works.

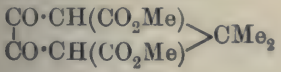
Dr. Harcourt, in reply to the President, stated that he had not analysed dust in the atmosphere of a pottery works, but lead could easily be estimated in an artificial dust prepared for special purposes.

*88. "Komppa's synthesis of camphoric acid."

By Gustave Louis Blanc and Jocelyn Field Thorpe.

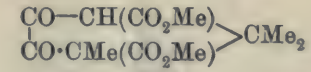
In the year 1903 (*Ber.*, **36**, 4332), Komppa published the preliminary notice of his synthetical preparation of camphoric acid. Last year (*Annalen*, 1909, **368**, 126; **370**, 209) he published the full experimental details involved in the synthesis.

In the last of these papers (*Annalen*, **370**, 220) he described the preparation of a compound which he called methyl diketocamphorate, and to which he assigned the formula (II). He prepared this compound by the action of sodium methoxide and methyl iodide on methyl diketo*apo*camphorate (I):



$$\left.\begin{array}{l}\mathrm{CO\cdot CH(CO_2Me)}\\ \mathrm{CO\cdot CH(CO_2Me)}\end{array}\right>\mathrm{CMe_2}$$

(I.)

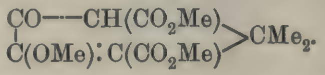


$$\left.\begin{array}{l}\mathrm{CO{-}CH(CO_2Me)}\\ \mathrm{CO\cdot CMe(CO_2Me)}\end{array}\right>\mathrm{CMe_2}$$

(II.)

This substance (II), which was the basis of his synthesis, is a well-defined, crystalline compound, melting at 85—88°. It was from the pure crystalline material that Komppa prepared camphoric acid (*loc. cit.*, p. 221).

The authors have now found that the substance melting at 85—88° is not, as Komppa supposed, the *C*-methyl derivative (II), but the *O*-methyl ether corresponding with the formula:



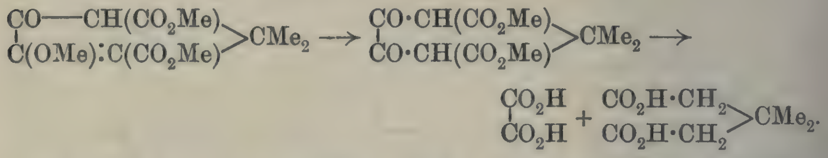
$$\left.\begin{array}{l}\mathrm{CO{-}{-}{-}CH(CO_2Me)}\\ \mathrm{C(OMe){:}C(CO_2Me)}\end{array}\right>\mathrm{CMe_2}.$$

The evidence in support of this view is as follows: when treated with cold aqueous potassium hydroxide, the substance melting at 85—88° is slowly hydrolysed, yielding:

(*a*) An amount of methyl diketo*apo*camphorate (I) melting at 116°, corresponding with 50 per cent. of the substance melting at 85—88° hydrolysed.

(*b*) An amount of ββ-dimethylglutaric acid melting at 101° from the residue corresponding with a further 40 per cent. of the above derivative hydrolysed.

The substance melting at 85—88° is therefore hydrolysed to the extent of 90 per cent. in accordance with the scheme:



$$\left.\begin{array}{l}\mathrm{CO{-}{-}CH(CO_2Me)}\\ \mathrm{C(OMe){:}C(CO_2Me)}\end{array}\right>\mathrm{CMe_2} \longrightarrow \left.\begin{array}{l}\mathrm{CO{\cdot}CH(CO_2Me)}\\ \mathrm{CO{\cdot}CH(CO_2Me)}\end{array}\right>\mathrm{CMe_2} \longrightarrow$$

$$\begin{array}{l}\mathrm{CO_2H}\\ \mathrm{CO_2H}\end{array} + \left.\begin{array}{l}\mathrm{CO_2H{\cdot}CH_2}\\ \mathrm{CO_2H{\cdot}CH_2}\end{array}\right>\mathrm{CMe_2}.$$

It would be in the highest degree improbable that a substance having the *C*-methyl constitution (II) would undergo hydrolysis in this manner, and the authors are therefore of the opinion that Komppa was in error in supposing that he obtained camphoric acid from the compound melting at 85—88° on reduction and hydrolysis.

DISCUSSION.

Dr. PICKLES asked if the authors had carried out a methoxyl determination on the original compound melting at 85—88°. Supposing that the compound had the formula which Komppa suggested, might it not be possible that in the subsequent treatment to which it had been subjected, before it was identified as the *O*-methyl ether, the methyl group had wandered from the carbon atom adjoining the carboxyl group?

Dr. THORPE replied that, as the methoxy-derivative so readily regenerated methyl diketo*apo*camphorate on treatment with cold alkali, M. Blanc and he were of the opinion that no useful purpose would be served by repeating the process of reduction with sodium amalgam in alkaline solution, used by Komppa.

*89. "Experiments on the Walden inversion. Part IV. The interconversion of the optically active phenylmethylglycollic acids." By Alex. McKenzie and George William Clough.

The authors have resolved *r*-phenylmethylglycollic acid into its optically active isomerides, and have also prepared *d*- and *l*-*α*-chloro-*α*-phenylpropionic acids. The displacement of chlorine in the latter compounds by the hydroxy-group has been investigated from the point of view of the Walden inversion.

*90. "Studies in fermentation. Part III. The rôle of diffusion in fermentation by yeast cells." By Arthur Slator and Henry Julius Salomon Sand.

Facts of a directly experimental nature lead to the belief that during the fermentation of a sugar by yeast, diffusion usually supplies the latter with material so rapidly that convection currents in the solution do not play any part in determining the apparent velocity of the reaction. An investigation has now been carried out by means of the apparatus described previously, in order to determine the limiting conditions under which convection currents would begin to become a controlling factor of the rate of the process. These have been deduced from the following formulæ, which were shown to represent with sufficient accuracy the changes of concentration in a stationary solution in which uniformly distributed yeast cells are operative: $C - C_0 = 3F/8\pi\kappa R$ and $C_1 - C_0 = F/8\pi\kappa R$. In this expression, C represents the concentration of the sugar at any point of the solution not in the immediate vicinity of a yeast cell, C_1 the concentration on the surface of a cell, C_0 the concentration at its centre, R its radius, and κ the diffusion coefficient of the sugar. F is the amount of sugar fermented per cell per unit of time, and was determined by experiment to be approximately 3×10^{-14} g/sec. at 30°.

Discussion.

Dr. Horace Brown fully recognised the importance of knowing the particular conditions under which diffusivity becomes a factor in limiting the specific activity of the yeast-cell. The results of an inquiry which he had made some time ago, employing the electrostatic analogy, were in substantial agreement with the conclusions of the authors, but he differed in some important points of detail, and considered that it was unnecessary to make any assumptions as to the particular mode in which absorption of the sugar takes place within the cell. The phenomena of steady diffusion induced by an absorbing sphere in a diffusive field are closely analogous to those presented by an insulated conductor of the same dimensions which has received an electrical charge. In the former case, when the permanent state has been reached, there are produced around the sphere a series of concentric shells of the diffusate which in distribution, although with opposite sign, correspond with the shells of equipotential in the dielectric surrounding the charged sphere. The variations in the gradient of concentration of the diffusate, as measured along the lines of flux, correspond exactly with the variations in the gradient of potential around the charged sphere, measured along the lines of force. In the special case of a spherical yeast-cell immersed in a solution of sugar, if the concentration of the diffusate at a remote point is represented by ρ, and that at the immediate surface of the cell by ρ_1, then the gradient of concentration at the surface, on which the rate of absorption depends, will be represented by $\frac{\rho - \rho_1}{r}$, r being the radius of the cell. If F be taken as the total absorption in unit time, then:

$$F = 4\pi r^2 \frac{(\rho - \rho_1)}{r} k = 4\pi r(\rho - \rho_1)k,$$

k being the coefficient of diffusivity of the sugar.

When actual values in *C.G.S.* units are substituted, and F has been experimentally determined, all the problems given by the authors can be solved by simple mathematical treatment, and without the necessity of making any assumptions as to the particular mode in which the sugar is dealt with in the interior of the cell or the amount of resistance introduced by the cell-membrane.

His (the speaker's) determinations of the amount of sugar fermented by a single yeast-cell in a second of time at a temperature of 17—20° led to a value of F of $0{\cdot}92 \times 10^{-14}$ gram. The authors of the paper had found $3{\cdot}0 \times 10^{-14}$ for a temperature of 30°. Taking into account the temperature-coefficient, which had been previously determined by Dr. Slator, these two results were almost identical.

One of the problems presented by the authors was to ascertain the minimal concentration, ρ, of a sugar solution which would be just sufficient to supply the yeast-cell with its requirements by diffusion only. From the above formula, and taking the value of F as $3{\cdot}0 \times 10^{-14}$, it follows that:

$$\rho - \rho_1 = \frac{3{\cdot}0 \times 10^{-14}}{4\pi r k} = 8{\cdot}52 \times 10^{-7},$$

that is to say, the minimal gradient of concentration at the surface of the cell must be 0·85 milligram per litre if these conditions are to be fulfilled. If the absorption of the sugar were complete at the exterior surface of the cell, then ρ_1 would be zero, and the required minimal concentration of the sugar solution, ρ, would be 0·85 milligram per litre. We know, however, that the metabolism of the sugar takes place within the cell, and therefore that ρ_1 must have a positive value, which, however, cannot exceed 0·85 milligram per litre if the gradient is to remain constant, and ρ is to be at a minimum.

The values ρ and ρ_1 can be evaluated by looking at the problem somewhat differently. Let it be supposed that all the fermentative processes are reversed, the activity of the cell as measured by F remaining the same. The cell will now emit sugar into the surrounding medium, and when ρ is at a minimum, that is, zero, the concentration ρ_1 at the exterior surface of the cell must equal the gradient, that is to say, must be equal to 0·85 milligram per litre if the outward flow is maintained at F. This must also represent the minimal surface concentration when the cell is absorbing sugar and ρ is also at a minimum; hence, under these latter conditions, $\rho = 2\rho_1 = 1{\cdot}70$ milligrams per litre, instead of 1·29 milligrams as found by the authors.

By the same reasoning it could be shown that with maximal stirring a concentration of 0·85 milligram per litre ought to be sufficient to supply the cell with its full requirements.

In this way it seems possible to avoid all complications introduced by having to take into account internal diffusion, the rate of metabolism and diffusion within the cell being included in the value of ρ_1, which can be evaluated by simple means.

Apart from all calculations of this kind, it is evident that diffusion can play but a very small part in limiting the activity of the cell when we consider the very large surface area represented by a relatively small amount of yeast. 0·1 Gram of pressed yeast, corresponding with about 0·025 gram of dry substance, contains about 4×10^8 cells, representing a surface area of 804 sq. cm. When this yeast is actively fermenting at 30°, this large area is called upon to deal with not more than about 43 milligrams of sugar per hour.

Dr. Slator, in reply, expressed the opinion that it was not possible to calculate these limiting conditions unless diffusion in the yeast cell itself was taken into consideration.

*91. "Syntheses of *p*-hydroxyphenylethylalkylamines."

By George Stanley Walpole.

The methylamino- and ethylamino-homologues of *p*-hydroxyphenylethylamine have been prepared in order that their physiological properties might be examined. The starting point was *p*-methoxyphenylethylamine and the series of reactions employed may be represented by the following scheme: $MeO{\cdot}C_6H_4{\cdot}CH_2{\cdot}CH_2{\cdot}NH_2 \longrightarrow MeO{\cdot}C_6H_4{\cdot}CH_2{\cdot}CH_2{\cdot}NHAc \longrightarrow MeO{\cdot}C_6H_4{\cdot}CH_2{\cdot}CH_2{\cdot}NAc(Alk) \longrightarrow HO{\cdot}C_6H_4{\cdot}CH_2{\cdot}CH_2{\cdot}NH(Alk)$.

Another series of compounds was prepared similar to the above, but in which the benzenesulphonyl group replaced the acetyl group whenever it occurred. In chemical and physical properties, p-*hydroxyphenylethylmethylamine* (m. p. 130°) and p-*hydroxyphenylethylethylamine* (m. p. 157—158°) resemble the parent substance, *p*-hydroxyphenylethylamine, very closely.

The *hydrochlorides* melt at 148·5° and 184—185° respectively. A *dibenzoyl* derivative, melting at 99°, and a platinichloride, melting at 205°, were prepared from the hydrochloride of *p*-hydroxyphenylethylmethylamine. The platinichloride corresponds exactly with the data given by Blau for the platinichloride prepared from the base obtained by the destructive distillation of surinamine. There is no longer room for doubt, therefore, that the latter substance is, as supposed, methyltyrosine.

92. "The condensation of anisaldehyde with resorcinol." By Frank George Pope and Hubert Howard.

In continuation of their previous work (*Trans.*, 1910, **97**, 78), the authors have condensed anisaldehyde with resorcinol, and have prepared 2 : 4-*dihydroxy*-4′-*methoxybenzhydrol* and its derivatives. 10-*Hydroxy*-7-*phenyldihydro*-*aβ*-*phenonaphthacridine* was also described.

93. "The influence of persulphates on the estimation of hydrogen peroxide with permanganate." By John Albert Newton Friend.

The author showed a few years ago (*Trans.*, 1904, **85**, 547, 1533; 1905, **87**, 738, 1367, and 1906, **89**, 1092) that, in ordinary circumstances, a correct estimate of hydrogen peroxide in the presence of potassium persulphate is not obtained by titration with permanganate, for the amount of the latter used always falls short of that required theoretically. It was further shown that, for every molecule of peroxide not accounted for by the permanganate, a molecule of persulphate disappears. This suggests that the reaction $H_2O_2 + K_2S_2O_8 = K_2SO_4 + H_2SO_4 + O_2$ is also taking place during the titration. As, however, it proceeds with extreme slowness in ordinary circumstances, the author assumed that it is here "catalytically accelerated by some oxide of manganese formed during titration."

In a recent communication (*Oesterr. Chem. Zeit.*, 1910, No. 3), Dr. A. Skrabal, whilst acknowledging the correctness of the experimental work, has suggested another interpretation. He says: "Nach unserer Meinung dürfte die von Friend beobachtete Erscheinung dadurch besser charakterisiert werden, dass man dieselbe in die Klasse der induzierten Reaktionen verweist. Wir nehmen also an, dass die Reaktion

$$5H_2S_2O_8 + 2KMnO_4 + 2H_2O = K_2SO_4 + 2MnSO_4 + 7H_2SO_4 + 5O_2$$

welche für sich allein nicht oder nur ausserordentlich langsam verläuft, durch die freiwillige und rasche Reaktion zwischen Hydroperoxyd und Permanganat induziert wird."

If, however, such were the case, it is clear that more permanganate would be required in the titrations than theory demands for the decomposition of the peroxide, the excess being measured by the extent to which the reaction between permanganate and persulphate is induced. Since less permanganate is actually required, such an explanation is seen to be untenable.

In a private communication, Dr. Skrabal has kindly given the author permission to state that he acknowledges the error, which arose through his consulting abstracts of the author's papers instead of the originals. He prefers, however, to regard the reaction which takes place between the persulphate and peroxide as "induced" rather than as catalytically accelerated by an oxide of manganese. This is merely a question of choice of terms, however, for induction is very frequently merely a special case of catalysis, neither of which is at present understood.

94. "Amido-oximes and thioamides." By William Fraser Russell.

The conversion of thioamides into amido-oximes by the action of hydroxylamine is restricted to those thioamides of the type R·CS·NHR, those of the formula R·CS·NRR scarcely being acted on by hydroxylamine under the same conditions. The author has prepared a number of thioamides of the second type, and the effect of hydroxylamine on them was described.

95. "Preparation of the acyl derivatives of the aldehyde-cyanohydrins. Part II." By Oliver Charles Minty Davis.

The reaction between acyl chlorides, aldehydes, and aqueous potassium cyanide (*Trans.*, 1909, **95**, 1403) has been further investigated, and found to be quite general for all types of aldehydes.

Benzoyl-lactonitrile, *a-benzoyloxy*iso*hexonitrile*, and *benzoyloxyoctonitrile* have been prepared; they are oils of high boiling points.

With the exception of acetone, it was found impossible to obtain compounds from ketones analogous to the aldehyde-cyanohydrin derivatives.

From acetone, *benzoyloxy*iso*butyronitrile*, m-*nitrobenzoyloxy*iso*butyronitrile*, and *carbethoxy*iso*oxybutyronitrile* were obtained.

The reactions of the acylaldehyde-cyanohydrins have also been investigated.

96. "Some derivatives of tetramethyl ferrocyanide."
By Ernald George Justinian Hartley.

Dry potassium ferrocyanide reacts readily with methyl sulphate at 80—90° with the formation of potassium methyl sulphate and a substance which could not be obtained pure, but probably has the composition $Me_4FeC_6N_6,2MeSO_4,2MeHSO_4$.

This, on further heating or on keeping in a vacuum, gives off methyl sulphate, and is converted into $Me_4FeC_6N_6,Me_2SO_4,H_2SO_4$, a very stable substance soluble in water and methyl alcohol, and crystallising well from the latter solvent. It gives none of the usual reactions for iron or for ferro- or ferri-cyanides, but on ignition leaves a residue of almost pure ferric oxide.

Both the above compounds give the same platinichloride as a very insoluble, crystalline precipitate from aqueous solutions. It has the composition $Me_6FeC_6N_6PtCl_6$. The formation of the $MeHSO_4$ groups in the first-mentioned substance has not yet been satisfactorily explained, but is probably due to moisture introduced during the experiment. Preliminary experiments show that potassium ferricyanide reacts in a similar way, but the products have not yet been analysed.

97. "The molecular refraction of thiocyanates and other salts."
By Augustus Edward Dixon and John Taylor.

From previous observations (Hawthorne, *Trans.*, 1906, **89**, 556; Dixon and Taylor, *ibid.*, 1908, **93**, 2153), it appears that, as calculated by the formula

$$M_D = \frac{p(\mu_D - 1)}{d\frac{t^\circ}{4^\circ}},$$

the mean refraction value of the group ·SCN in organic combinations is about 23·3 units; it is now shown that the refraction effect of this group in the thiocyanates of sodium, potassium, ammonium, calcium, and aluminium is considerably higher, the mean value being about 26 units. In this respect the ·SCN group resembles the halogens, which give higher values in metallic salts than in organic combinations.

The refraction value of the group C_2O_4 was found to be substantially the same in potassium oxalate and in ethyl oxalate, the mean numbers being 21·6 and 21·8 respectively. For SO_4 in sodium, potassium, and ammonium sulphates, the mean value was 16·89; in various alkyl sulphates, 17·53, and in ethyl sulphate, 18·91; this was the only case noted in which an acid residue gives a lower value in metallic salts than in esters.

Silicon thiocyanate showed in its chemical behaviour no sign of being a thiocarbimide: this agrees with the conclusion of Emerson Reynolds (*Trans.*, 1906, **89**, 397).

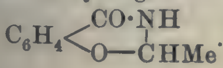
98. "Estimation of carbon in iron and steel and in iron alloys by direct combustion." By Thomas Ernest Hull.

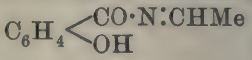
In the process which is often recommended for determining the carbon-content of iron alloys (ferromanganese, ferrosilicon, silicospiegel, etc.), namely, to ignite the drillings with powdered and ignited lead chromate, the author finds that, at the high temperature involved (800—960°), the lead chromate is decomposed into chromic oxide and basic lead chromate, and that the former is not retained in the usual drying apparatus, and consequently is absorbed by the potash in the potash-bulbs, thus leading to a high result in the amount of carbon found. There is no doubt that the decomposition of the lead chromate is solely due to the high temperature employed.

The following method for the determination of carbon in iron and steel is found to be both simple and accurate. The finely-drilled sample is weighed into an asbestos boat (made from strips of moistened asbestos millboard), which has been previously heated to full redness, and into which a layer of recently ignited silver sand has been introduced. The ignition in oxygen is carried out at 900—960°, the residual gases are dried by passing through concentrated sulphuric acid contained in a Mohr's bulb, and the carbon dioxide is absorbed by 30 per cent. potassium hydroxide solution in the usual weighed bulbs. In the case of ferromanganese, etc., it is advisable to ignite the finely-powdered sample with zinc oxide. The porcelain or silica-glass tube is always packed loosely with asbestos and copper oxide.

99. "2-Methyl-1 : 3-benzoxazine-4-one and related derivatives." By William Longton Hicks.

Salicylamide and acetaldehyde (paraldehyde) condense under the influence of hydrogen chloride at 80° to form 2-*methyl*-1 : 3-*benzoxazine*-4-*one*,



$C_6H_4{<}\begin{matrix}CO\cdot NH\\ | \\ O—CHMe\end{matrix}$. The oxazine ring may be ruptured by means of sodium hydroxide in pyridine solution, the resulting compound being syn-*ethylidenesalicylamide*,  $C_6H_4<\begin{matrix}CO\cdot N{:}CHMe\\ OH\end{matrix}$, which readily regenerates the oxazine on melting.

The corresponding *anti*-form shows no such labile properties.

100. "The examination of the atmosphere at various altitudes for oxides of nitrogen and ozone." By Walter Hayhurst and John Norman Pring.

Methods were devised to carry out accurately a qualitative examination of the atmosphere for the presence of ozone and oxides of nitrogen at various altitudes. Experiments were made systematically on and above Glossop Moor, in Derbyshire, during three or four months in summer, and were supplemented by a number of tests on sea- and mountain-air at various places in this country. It was found that oxides of nitrogen were always present in quantities which vary largely from time to time, and that the amount of ozone was, in every case, too small to be detected in the experiments conducted at ground level and at intermediate altitudes (up to 8000 feet). It was shown, in consequence, that the amount of ozone is less than 0·003 milligram in the quantity of air dealt with in each experiment (between 1 and 10 cubic metres).

Experiments at very high altitudes, ranging up to ten miles, were carried out with the help of free balloons, and in these the presence of small quantities of ozone, averaging about 0·2 milligram in 0·1 to 0·3 cubic metre of air, was detected; the quantity of oxides of nitrogen was found to be rather less.

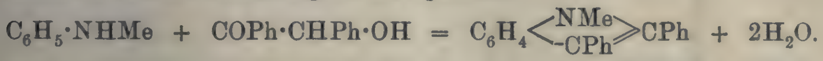
101. "Derivatives of *S*-alkylphenazothionium." By Edward de Barry Barnett and Samuel Smiles.

Whilst thiodiphenylamine and methyl iodide when heated together yield the *N*-methyl derivative, these reagents in presence of mercuric iodide at the atmospheric temperature furnish the methyl-sulphonium iodide. This substance reacts with silver oxide, yielding S-*methylphenazothionium*.

102. "Preparation of substituted indoles from benzoin and secondary arylamines." By Marion Brock Richards.

Japp and Murray (*Trans.*, 1894, **65**, 889) showed that by heating benzoin with primary arylamines in presence of zinc chloride or of the hydrochloride of the amine, 2 : 3-diphenylindoles could be prepared.

The author now finds that, by employing secondary in place of primary arylamines, substituted diphenylindoles may be obtained. Thus by the interaction of benzoin and methylaniline in presence of zinc chloride or of methylaniline hydrochloride, 2:3-diphenyl-1-methylindole is formed, according to the equation:



$$C_6H_5{\cdot}NHMe + COPh{\cdot}CHPh{\cdot}OH = C_6H_4{<}\genfrac{}{}{0pt}{}{NMe}{CPh}{>}CPh + 2H_2O.$$

In like manner, by employing other arylamines, corresponding diphenylindoles have been prepared.

103. "The interaction of hydrogen and chlorine. The nature of photochemical inhibition." By David Leonard Chapman and Patrick Sarsfield MacMahon.

The nature of photochemical inhibition was discussed. Experiments on the inhibitive influence of ozone and chlorine dioxide on the interaction of chlorine and hydrogen in light (of which a preliminary account has already appeared) were described in detail. A description was also communicated of experiments which showed that the influence of chlorine monoxide on the rate of combination of hydrogen and chlorine is inappreciable.

104. "A new synthesis of thioxanthone and its derivatives." By Eric Gordon Davis and Samuel Smiles." (Preliminary note.)

o-Carboxybenzenesulphinic acid, which is prepared by reducing the chloride of *o*-sulphobenzoic acid with sodium sulphite, may be condensed with benzene, naphthalene, or their derivatives in presence of dehydrating agents, yielding the corresponding thioxanthones. The preparation of *o*-carboxybenzenesulphinic acid is troublesome, but it is not necessary directly to prepare the acid in order to obtain the desired thioxanthone. Thus thiosalicylic acid in presence of suitable oxidising agents may be directly condensed with aromatic substances, giving the compounds in question. The yields obtained by the latter method are between 80 and 90 per cent. of the theoretical. A more complete investigation of the reaction and its products is now being made.

105. "The action of phosphorus pentachloride on dibenzamide." By Arthur Walsh Titherley and Elizabeth Worrall.

Dibenzamide in presence of chloroform or ether reacts readily with phosphorus pentachloride, yielding *a*-chloro-*N*-benzoylbenzimide, $C_6H_5{\cdot}CCl{:}NBz$, identical with the product of the action of phosphorus pentachloride on α-benzilmonoxime (Beckmann, *Annalen*, 1897, **296**, 279). α-Chlorobenzoylbenzimide readily undergoes fission above 100° into benzoyl chloride and benzonitrile, and with boiling water, benzoic acid and benzonitrile are formed. On the other hand, by the action of cold water for four or five weeks, or atmospheric moisture at 100° for twenty-four hours, much dibenzamide is produced, together with benzoic acid and benzonitrile, derived by simultaneous fission. Dibenzamide is also produced in good yield by treatment with cold concentrated sulphuric acid and subsequent dilution with water.

106. "Amphoteric metallic hydroxides. Part II." By John Kerfoot Wood.

The author has continued his investigations of the basic and acidic characters of various metallic hydroxides (*Trans.*, 1908, **93**, 411). The hydroxides now examined are those of zinc, glucinum, and lead. It is found that lead hydroxide is both the strongest acid and strongest base; glucinum hydroxide is the weakest base, and zinc hydroxide the weakest acid. The order of acidity agrees with that arrived at by Hantzsch by other methods (*Zeitsch. anorg. Chem.*, 1902, **30**, 302). The author agrees with Hantzsch in considering the formula of sodium plumbite to be $Pb(OH)ONa$, but differs in his views as to the formula of the salt present in a solution of sodium zincate. The form of the curve showing the solubility of zinc hydroxide in solutions of sodium hydroxide of varying concentration points to sodium zincate having the formula $Zn(ONa)_2$. Glucinum forms a salt of analogous composition to that of sodium zincate, but there is also some evidence in support of the existence of a compound having the formula

$$Gl(OH)ONa.$$

107. "The action of methyl *tert.*-butyl ketone on ketols. Part I." By Alfred Archibald Boon.

The author has found that methyl *tert.*-butyl ketone does not condense in the presence of potassium cyanide with furoin; but with benzoin a γ-diketone ($C_{20}H_{22}O_2$) was obtained after prolonged action. This compound is almost colourless, soluble in most organic solvents, and melts at 110—111°. It forms a monoxime and a dioxime; the latter decomposes at its melting point (210°).

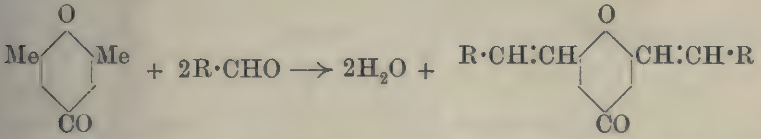
Only one substance, although two others appear to be formed at the same time, was isolated in the pure state when phenylhydrazine was allowed to act on the γ-diketone. This compound, 1-*anilino*-2-tert.-*butyl*-4 : 5-*diphenylpyrrole* or 1 : 3 : 4-*triphenyl*-6-tert.-*butyldihydropyridazine*, melts at 167—168°, and was obtained in very small amount.

The pyrrole-red reaction was given by the γ-diketone, and from it was obtained: 2-*tert.*-butyl-4:5-diphenylfuran, $C_{20}H_{20}O$, m. p. 68—69° (*Trans.*, 1904, **85**, 1497), and the following pyrrole derivatives: a *compound*, $C_{20}H_{21}N$, m. p. 98—99°, and 1-*phenyl*-2-tert.-*butyl*-4:5-*diphenylpyrrole*, m. p. 202—203°.

Several attempts were made to prepare a thiophen derivative from the compound $C_{20}H_{22}O_2$, but without success. From the author's experiments it would appear that the *tert.*-butyl group has some direct influence on the formation of the thiophen and furan derivatives.

108. "Contributions to our knowledge of oxonium compounds." (Preliminary note.) By Alfred Archibald Boon, Kenneth McKenzie, and John Fountain Reid.

Aldehydes can be condensed with dimethylpyrone, giving coloured bases, which form intensely coloured oxonium salts with acids. From furaldehyde a canary-yellow base (m. p. 200°) was obtained, and from benzaldehyde, a pale yellow compound (m p. 169°). The salts are either bright red or bright yellow. The study so far indicates that the colour of the salts depends on the nature of the aldehyde used in condensation, as well as that of the acids employed in their production. The condensation takes place according to the following scheme:



The investigation is being continued with aldehydes and similar compounds both from the chemical as well as the physico-chemical point of view; more particularly the determination of the affinity values of these bases is contemplated.

109. "The effect of contiguous unsaturated groups on optical activity. Part V. Physico-chemical evidence of the structure of 'α-disulphoxides.'" By Thomas Percy Hilditch.

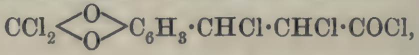
The possibility of applying the known relations between optical rotatory power and constitution to determining the structure of organic compounds was discussed.

An attempt has been made to decide between the alternative formulæ $R·SO_2·S·R$ and $R·SO·SO·R$ for the compounds known as "disulphoxides." The polarimetric examination of *dicamphoryl-β-*

disulphoxide, methyl- and n-*butyl-camphoryl-β-disulphoxides,* and *sodium camphor-β-thiosulphonate* indicates that whilst compounds containing identical alkyl groups, R, R, exist undoubtedly in the symmetrical form (true disulphoxides), those in which the two groups R, R′ are not the same may exist in the thiosulphonic form (when R differs widely in nature or mass from R′) or in the true disulphoxide form (when R approximates to R′). No evidence of transitional forms has, however, been obtained. Additional evidence has been drawn from the behaviour of disulphoxides towards alcoholic hydrogen chloride.

110. "The action of phosphorus pentachloride on some unsaturated compounds." By Reginald William Lane Clarke.

Piperonylacrylic acid (3 : 4-methylenedioxyphenylacrylic acid) when treated with phosphorus pentachloride at 160° yields *α : β-dichloro-3 : 4-dichloromethylenedioxyphenylpropionyl chloride,*

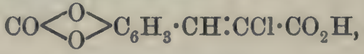


$$CCl_2{<}\substack{O\\O}{>}C_6H_3\cdot CHCl\cdot CHCl\cdot COCl,$$

showing that not only are the hydroxyl group and the two methylene hydrogen atoms replaced by chlorine, but also that the substance unites with chlorine at the ethenoid linking. From this substance *αβ-dichloro-3 : 4-carbonyldioxyphenylpropionic acid,*

$$CO{<}\substack{O\\O}{>}C_6H_3\cdot CHCl\cdot CHCl\cdot CO_2H,$$

α-chloro-3 : 4-carbonyldioxyphenylacrylic acid,



$$CO{<}\substack{O\\O}{>}C_6H_3\cdot CH{:}CCl\cdot CO_2H,$$

and *α-chloro-3 : 4-dihydroxyphenylacrylic acid* (*α-chlorocaffeic acid*),

$$C_6H_3(HO)_2\cdot CH{:}CCl\cdot CO_2H,$$

have been obtained.

In view of this behaviour of piperonylacrylic acid, the action of phosphorus pentachloride on other unsaturated substances has been investigated under similar conditions.

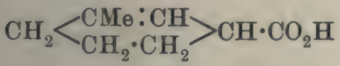
Cinnamic acid was found to yield *αβ-dichloro-β-phenylpropionyl chloride,* $C_6H_5\cdot CHCl\cdot CHCl\cdot COCl$. α-Chlorocinnamic acid gave *ααβ-trichloro-β-phenylpropionyl chloride,* $C_6H_5\cdot CHCl\cdot CCl_2\cdot COCl$, from which the corresponding *acid* and *methyl* ester were obtained.

Phenylpropiolic acid gave *αβ-dichlorocinnamyl chloride,* 2 : 3-*dichloroindenone*, and 2 : 2 : 3 : 3-*tetrachlorohydrindone.*

Crotonic acid yielded *αβ-dichlorobutyryl chloride,* and cinnamaldehyde gave an *αβγγ-tetrachloro-α-phenylpropane*, different from that obtained by Charon and Dugoujon (*Compt. rend.*, 1903, **136**, 94).

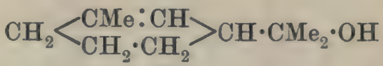
111. "Experiments on the synthesis of the terpenes. Part X (continued). Synthesis of sylvestrene (*d*-carvestrene)." (Preliminary note.) By William Henry Perkin, jun.

In a previous communication (*Trans.*, 1907, **91**, 480) the synthesis of *dl*-1-methyl-Δ^1-*cyclo*hexene-3-carboxylic acid (I) was described, and it was shown that the ester of this acid, on treatment with magnesium methyl iodide, is converted into *dl*-dihydrocarvestrenol or Δ^1-*m*-menthenol-(8) (II). This tertiary alcohol is readily decomposed by boiling with potassium hydrogen sulphate, with elimination of water and formation of *dl*-carvestrene (III).



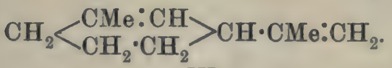
$$CH_2{<}\begin{matrix}CMe{:}CH\\CH_2{\cdot}CH_2\end{matrix}{>}CH{\cdot}CO_2H$$

(I.)



$$CH_2{<}\begin{matrix}CMe{:}CH\\CH_2{\cdot}CH_2\end{matrix}{>}CH{\cdot}CMe_2{\cdot}OH$$

(II.)



$$CH_2{<}\begin{matrix}CMe{:}CH\\CH_2{\cdot}CH_2\end{matrix}{>}CH{\cdot}CMe{:}CH_2.$$

(III.)

The author has now succeeded in resolving *dl*-1-methyl-Δ^1-*cyclo*hexene-3-carboxylic acid by means of brucine, and the d-*acid* thus obtained distils at 142°/20 mm. and has $[\alpha]_D$ +70°,

Ethyl d-1-*methyl*-Δ^1-cyclo*hexene-3-carboxylate*, which distils at 143—144°/100 mm. and has $[\alpha]_D$ +66°, reacts readily with magnesium methyl iodide, with the formation of d-*dihydrocarvestrenol* or Δ^1-*m*-menthenol-(8), which distils at 108—111°/30 mm. and has the constitution represented by II. It is remarkable that this tertiary alcohol is optically inactive, but that it is in reality *d*-dihydrocarvestrenol is shown by the fact that, when treated with hydrochloric acid, it yields d-*carvestrene dihydrochloride*. This substance melts sharply at 72°, has $[\alpha]_D$ +22·0°, and is identical with sylvestrene dihydrochloride, as was proved by direct comparison with a specimen of this hydrochloride, for which the author is indebted to Prof. Wallach.

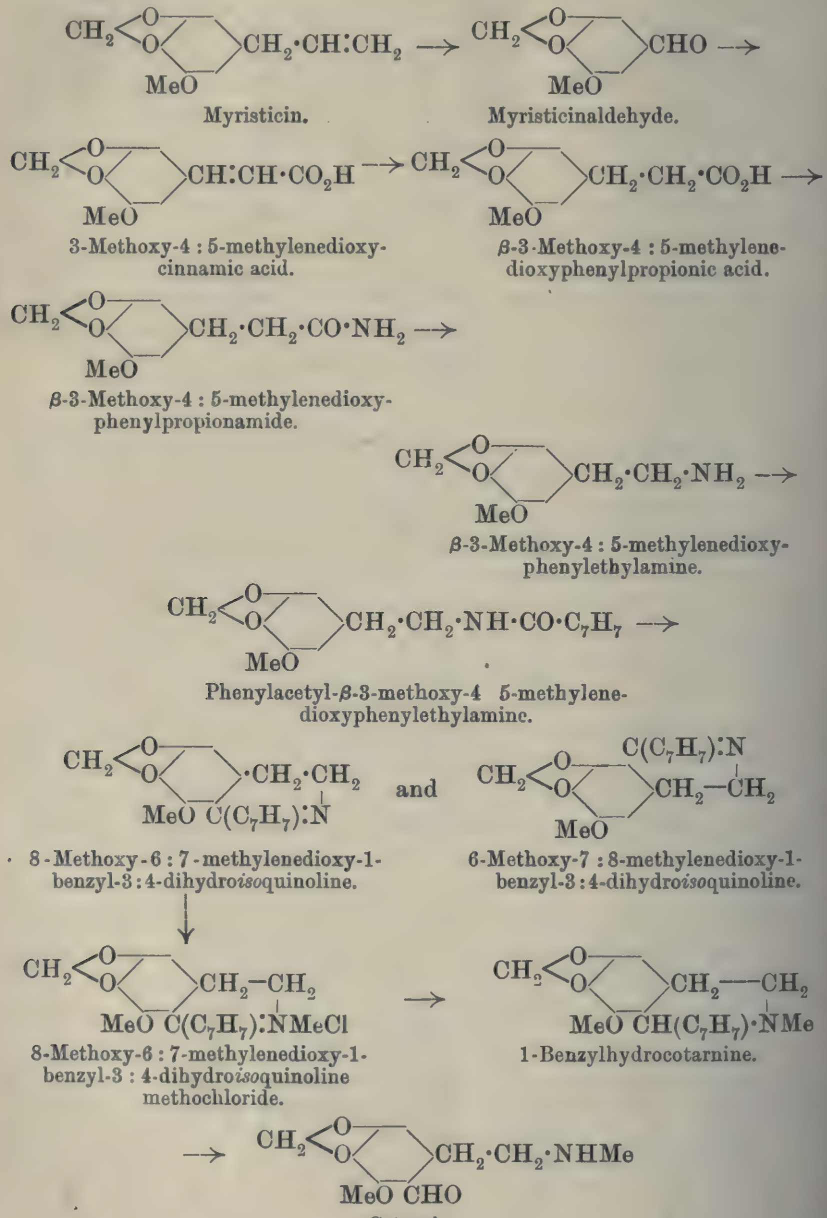
The latter melted at 72° and had $[\alpha]_D$ +22·6°, and when mixed with the synthetical dihydrochloride there was no alteration in melting point.

Since sylvestrene dihydrochloride yields sylvestrene on treatment with aniline, the synthesis of this important terpene is complete, and these experiments prove conclusively that sylvestrene is the dextro-modification of carvestrene and has the constitution represented by the formula (III) given above.

112. "Synthesis of cotarnine." (Preliminary note.)

By Arthur Henry Salway.

The synthesis of cotarnine has been accomplished according to the following series of reactions :



Myristicin.

Myristicinaldehyde.

3-Methoxy-4 : 5-methylenedioxycinnamic acid.

β-3-Methoxy-4 : 5-methylenedioxyphenylpropionic acid.

β-3-Methoxy-4 : 5-methylenedioxyphenylpropionamide.

β-3-Methoxy-4 : 5-methylenedioxyphenylethylamine.

Phenylacetyl-β-3-methoxy-4 5-methylenedioxyphenylethylamine.

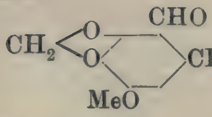
8-Methoxy-6 : 7-methylenedioxy-1-benzyl-3 : 4-dihydro*iso*quinoline.

6-Methoxy-7 : 8-methylenedioxy-1-benzyl-3 : 4-dihydro*iso*quinoline.

8-Methoxy-6 : 7-methylenedioxy-1-benzyl-3 : 4-dihydro*iso*quinoline methochloride.

1-Benzylhydrocotarnine.

Cotarnine.

An isomeride of cotarnine,  has also been obtained in the above synthesis.

113. "Note on the usually-adopted method of calculating additive physico-chemical constants." By Herbert Stanley Redgrove.

The author adduced several examples to show that, in calculating the molecular heat of combustion and the molecular heat of formation, the number and kind of affinity-bonds made and broken must be taken into account.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Abderhalden, *Emil.* [Editor.] Handbuch der biochemischen Arbeitsmethoden. Vol. I. ii., pp. xxvii + 513 to 698. ill. Wien 1910. (*Recd.* 11/3/10.)
From the Publishers: Messrs. Urban and Schwarzenberg.

American Electrochemical Society. Transactions. Vol. XVI. Philadelphia 1909. (*Reference.*) From Dr. F. Mollwo Perkin.

Barnet Book of Photography. 9th edition. pp. 316. ill. Barnet 1907. (*Recd.* 26/2/10.)
From the Publishers: Messrs. Elliott and Sons.

Boerhaave, *Hermann.* A new method of chemistry. 2nd edition. Translated by *Peter* **Shaw**. [Vol. I.] pp. xxx + 594. London 1741. (*Reference.*) From the Pharmaceutical Society.

Duparc, *Louis*, and **Basadonna**, *Mario.* Manuel théorique et pratique d'analyse volumétrique. pp. iv + 170. ill. Genève 1910. (*Recd.* 28/2/10.) From the Authors.

Institute of Metals. Journal. Vol. II. 1909. Edited by *G. Shaw* **Scott.** pp. viii + 342. ill. London 1909. (*Reference.*)
From the Institute.

Royal Medical and Chirurgical Society. The climates and baths of Great Britain. Vol. II. pp. xvi + 628. Maps. London 1902. (*Recd.* 10/3/10.) From the Society.

Thomson, *Thomas.* A system of chemistry. 5th edition. 4 vols. pp. xii + 567 [wanting v—viii], viii + 700, vii + 618, viii + 684. London 1817. (*Recd.* 11/3/10.) From the Pharmaceutical Society.

Tutton, *Alfred Edwin Howard.* Crystalline structure and chemical constitution. pp. viii + 204. ill. London 1910. (*Recd.* 19/2/10.)
From the Author.

II. *By Purchase.*

Lunge, *George.* Coal-tar and ammonia. 4th edition. 2 vols. pp. xix + 563, xiii + 564 to 1178. ill. London 1909. (*Recd.* 22/2/10.)

Orthey, *Max.* Die Metallhüttenchemie. pp. xiv + 532. ill. Leipzig 1910. (*Recd.* 8/3/10.)

III. *The under-mentioned Pamphlets have been presented to the Library by Professor Körner.*

Körner, *William.* Sulla costituzione dell' acido veratrico e del veratrol. (From the *Rend. R. Ist. Lombardo,* 1876, [2], **9**.)

—— Intorno ad alcuni prodotti di trasformazione della chinolina. (From the *Rend. R. Ist. Lombardo,* 1881, [2], **14**.)

—— Intorno all' acido caffeico ottenuto dalla *Cincona Cuprea.* (From the *Rend. R. Ist. Lombardo,* 1882, [2], **15**.)

—— Richerche sulla composizione e costitutuzione della siringina, un glicoside della *Syringa Vulgaris.* (From the *Rend. R. Ist. Lombardo,* 1888, [2], **21**.)

Körner, *William,* and **Bertoni,** *Giacomo.* Sintesi di due nuovi acidi isomeri al vanillico. (From the *Rend. R. Ist. Lombardo,* 1884, [2], **13**.)

Körner, *William,* and **Böhringer,** *Christian.* Intorno agli alcaloidi della corteccia di angustura. (From the *Rend. R. Ist. Lombardo,* 1883, [2], **16**.)

Körner, *William,* and **Contardi,** *Angelo.* Alcuni derivati nitroalogenati della benzina, dell' anilina e dell' acetanilide. (From the *Annuario Soc. Chim. Milano,* 1908, **14**.)

Körner, *William,* and **Menozzi,** *Angelo.* Trasformazione dell' acido aspartico in acido fumarico. (From the *Rend. R. Ist. Lombardo,* 1880, [2], **13**.)

—— —— Eliminazione dell' azoto dalla tirosina. (From the *Rend. R. Ist. Lombardo,* 1881, [2], **14**.)

—— —— Intorno all' azione de jodure metilico sulla leucina ed altre sostanze analoghe. (From the *Rend. R. Ist. Lombardo,* 1883, [2], **16**.)

—— —— Intorno ad un nuovo acido isomero all' aspartico. (From the *Rend. R. Ist. Lombardo,* 1885, [2], **19**.)

—— —— Trasformazione degli acidi fumarico e maleico in acido aspartico e in asparagina. (From the *Rend. R. Ist. Lombardo,* 1887, [2], **20**.)

Körner, *William,* and **Wender,** *V.* Intorno ad alcuni nuovi derivati di sostituzione della benzina. (From the *Rend. R. Ist. Lombardo,* 1886, [2], **19**.)

Zanoni, *G.* Sintesi della β-metilpiridina (β-picolina). (From the *Rend. R. Ist. Lombardo*, 1881, [2], **14**.)

Together with 16 reprints of papers published in journals already in the Library.

BANQUET TO PAST PRESIDENTS.

The Banquet will be held at the Savoy Hotel (Embankment Entrance) on Thursday, May 26th, 1910, at 7 for 7.30 p.m., in honour of the following Past Presidents who have attained their Jubilee as Fellows of the Society:

	Elected	Served as President
Prof. William Odling, F.R.S.	1848	1873–1875.
The Rt. Hon. Sir Henry E. Roscoe, F.R.S.	1855	1880–1882.
Sir William Crookes, F.R.S.	1857	1887–1889.
Dr. Hugo Müller, F.R.S.	1859	1885–1887,
Dr. A. G. Vernon Harcourt, F.R.S. ...	1859	1895–1897.

The price of tickets will be One Guinea (£1 1*s.*) each (including wine), or Half-a-Guinea (10*s.* 6*d.*) each (not including wine).

All applications for tickets must be received not later than Friday, May 20th, next.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, made payable to "Mr. S. E. Carr," and addressed to the Assistant Secretary, Chemical Society, Burlington House, W.

At the next Ordinary Scientific Meeting on **Thursday**, May **5th**, 1910, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"The correlation of rock and river-water analyses." By H. S. Shelton.

"The composition and synthesis of caoutchouc." By S. S. Pickles.

"The constituents of the flowers of *Trifolium incarnatum*." By H. Rogerson.

"The absorption spectra of nicotine, conine, and quinoline as vapours, liquids, and in solution." By J. E. Purvis.

"Fluorones." By F. G. Pope and H. Howard.

"The triazo-group. Part XIII. Triazomethylcarbimide (triazomethyl*iso*cyanate)." By M. O. Forster and R. Müller.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, May 5th, 1910.

Bethwaite, John,

48, Northumberland Street, Workington, Cumberland.

Analytical Chemist. Chief Chemist and Manager for Messrs. Hardy, Dougall & Co., Analysts, Maryport, London, Cardiff, and Duisburg (Germany). Studied at the Cumberland County Council Science School, Workington. Trained in the Laboratory of the West Cumberland Iron and Steel Co., Ltd. Afterwards Assistant Chemist at the Lowther Iron Works, Workington; and Chief Assistant, Messrs. Hardy, Dougall & Co.

Pattinson B. Melmore. H. E. Wright.
J. J. Morgan. *J. M. Davey.*
Robert Hellon.

Bourdillon, Robert Benedict,

Buddington, Midhurst, Sussex.

Student of Chemistry. Have studied Chemistry at the Universities of Freiburg i.B. and Oxford during the last two years.

Harold Hartley. N. V. Sidgwick.
N. Garrod Thomas. H. B. Baker.
D. H. Nagel.

Brady, Oscar Lisle,

51, Upper Bedford Place, London, W.C.

Student. Bachelor of Arts (Honours Chemistry) University of the Cape of Good Hope. For a short time lecturer in Chemistry at Grey University College, Bloemfontein. At present research student in Organic Chemistry at University College, London.

William Ramsay. Samuel Smiles.
J. Norman Collie. Percy May.
H. Thacher Clarke.

Buswell, Henry Leslie Farmer,

169, Queen's Gate, S.W.

Analytical Chemist. Bachelor of Arts, Cambridge Science Tripos. "Chloroform Apnœa and its Causes," in conjunction with Dr. Collingwood, M.D., etc.

Thos. Farries.	*Francis H. Carr.*
Reginald G. Halstead.	*Frank L. Pyman.*
J. B. Knight.	*F. G. P. Remfry.*

Cheetham, Thomas Patrick,

Vrijheid, Natal, S.A.

Teacher, Trained Cert., Bd. Edn., Eng.; Cert., First Class, Natal Ed. Dept. Undergraduate, London and "Cape" Universities. Student and Teacher in Science for past ten years (Chemistry, Physics, Biology, Geology, Astronomy). Lond. Matric. Chemistry, '03. Read Lond. Inter. Sci., '03–04. Teachers' Course Chemistry, '05–06. L.C.C. Class, King's College, London. Orgnsg. Tr. Cl. Science in Lond., '06. Prep. Candidates for Teachers' Govt. Science, 3rd Grade, Natal Examn., 1907. Lecturer in Chemistry, Govt. Technical Classes, Durban Tech. Inst., 1907. In charge of Matric. Class and All Science Teaching, Govt. Sch., Vrijheid, 1908 to present time. Hon. Meteorological Observer to Govt. Observatory, Durban; at Vrijheid at present; and have given popular Chemical Lectures in Durban and Vrijheid.

Thos. William Dukes.	J. S. Jamieson.
E. Nevill.	*A. M. Neilson.*

A. B. Tonkin.

Clarke, Herbert Edmund,

20, Grosvenor Road, Jesmond, Newcastle-on-Tyne.

Chemist to Messrs. Cookson & Co., Ltd., Wellington Quay-on-Tyne. Second Class in Honours, School of Natural Sci., Oxford, 1907. Research B.Sc. degree, Oxford, 1909. Joint author with Mr. D. L. Chapman, M.A., of "The Measurement of a Homogeneous Chemical Change in a Gas" (*J.C.S.*, Trans., 1908, p. 1638). Chemist at Messrs. Cookson's Lead Works, Hay Hole, Wellington Quay-on-Tyne, 1909.

H. Brereton Baker.	A. F. Walden.
W. W. Fisher.	J. E. Marsh.
N. V. Sidgwick.	D. L. Chapman.

Dickson, Thomas William,

153, Finborough Road, South Kensington, S.W.

Assistant in Mathematical and Mechanical Department, City and

Guilds Central Technical College, London. Second Class Honours in Chemistry, Oxford. Mathematical and Science Master at Bilton Grange School, Harrogate, for one year. Assistant to F. W. Toms, Esq., Official Analyst for Jersey, for six months.

J. E. Marsh.
F. W. Toms.
R. de J. Fleming Struthers.
John Watts.
T. V. Barker.
Andrea Angel.
H. R. Le Sueur.

Farrands, Harry,

The College, Isleworth.

Lecturer in Chemistry. Master of Arts, Oxford University. Second Class Honours degree in Natural Science (Chemistry), '05. Lecturer in Chemistry, Borough Road Training College, Isleworth, to students reading for London University B.Sc. degrees, 1905–1910.

H. E. W. Phillips.
R. M. Caven.
Henry J. S. Sand.
F. S. Kipping.
Andrea Angel.

Garland, Charles Samuel,

18, Derwent Grove, Dulwich, S.E.

Associate in Chemistry of the Royal College of Science ; at present engaged as Assistant Demonstrator.

T. E. Thorpe.
M. O. Forster.
James C. Philip.
G. T. Morgan.
A. Clayton.
W. Godden.

Goldsbrough, Harold Albert,

Churchside, Herne Hill, London, S.E.

Analytical Chemist. Assistant to Dr. Philip Schidiowitz, F.C.S., of 57, Chancery Lane, W.C. Student of Chemistry under A. C. Chapman, Esq., F.I.C., F.C.S., and for two years at Finsbury Technical College. Holder of that College's City and Guilds Institute Certificate. Associate of the Institute of Chemistry. Co-author with Dr. Philip Schidrowitz of "The Viscosity of Indiarubber and Indiarubber Solutions," in *Journal of Society of Chemical Industry*, Jan. 15th, 1909.

Philip Schidrowitz.
R. Meldola.
George T. Holloway.
Alf. Chaston Chapman.
F. Henry Streatfeild.

Harrison, Edwin,

18, Old Swan Lane, Upper Thames Street, London, E.C.

Manufacturing Chemist. Am desirous of being in touch with current scientific literature.

J. H. B. Wigginton.
W. Carter White.
John C. Umney.
C. T. Bennett.
Ernest J. Parry.

Jones, William Jacob,

Queen's Terrace, Llanrwst.

Research Student. Fellow of the University of Wales. B.Sc. (Wales) 1908, 1st Class Honours in Chemistry. Joint author of papers: (1) "A Crystalline Bleaching Powder," (2) "The Chlorination of Acetanilide," (3) "The Primary Interaction between Chlorine and Anilides," all published in *Trans.*, Vol. 95; also (4) "The Estimation of the Alkalinity of Bleaching Powder," *Analyst*, 1909.

Kennedy J. P. Orton. J. J. Sudborough.
H. O. Jones. *Claude M. Thompson.*
J. E. Coates.

Kenner, James,

61, Marlborough Road, Sheffield.

Research Assistant and Demonstrator in Chemistry in the University of Sheffield. Ph.D. (Heidelberg); B.Sc. (London). Joint author with Dr. Hewitt and Mr. Silk of a paper on "The Bromination of Phenols," and with Prof. Knoevenagel of a paper "Zur Darstellung der Sulfinsäuren."

W. Palmer Wynne. J. T. Hewitt.
W. E. S. Turner. Clarence Smith.
F. G. Pope.

Kwoh, Sea-Kwain,

125, Acomb Street, Manchester.

Student. Research Student. Associate of Municipal School of Technology. Hold Certificate of Victoria University in Technological Chemistry.

Jas. Grant. F. S. Sinnatt.
S. J. Peachey. E. L. Rhead.
L. G. Radcliffe. *F. G. Richards.*

Lamb, Samuel,

May Villa, Birmingham Road, West Bromwich.

Chemist (Messrs. Chance's Glass and Lighthouse Construction Works). 1st Associate of Royal School of Mines. Honoursman in Chemistry (org. and inorg.—theo. and prac.), Board of Education. National Scholar in Chemistry, 1905.

S. Herbert Cox. F. W. Harbord.
W. Gowland. W. H. Merrett.
E. O. Courtman.

Lewis, Frederick Charles,

20, Eskburn Road, Liverpool.

Assistant Director Clinical Research Department, University of Liverpool. Assistant to Sir R. Boyce, F.R.S., one of the Public

Analysts, and Bacteriologist to City of Liverpool, etc. Has had extensive experience in Consulting Bacteriology; also Pathology and Physio-Chemistry, including investigation and analysis. Has conducted researches into: 1. Cause and Prevention of "Ropiness" in Bread. 2. Cause of Deterioration and Liquefaction of certain Commercial Products (Joint). 3. Chemistry and Pathology of Degenerating Fibromyomata (Joint). 4. Chemistry of certain Organic Solutions Artificially Infected with Specific Bacteria.

Gilbert J. Fowler.
John Hanley.
James Ed. Southcombe.
Alfred Smetham.
Prosper H. Marsden.
William Ramsay.
Bernard Dyer.

Lucking, Hubert Leslie,

St. Mary's, West Heath Road, Hampstead, N.W.

Research Student. Ph.D. (Heidelberg). Studying Chemistry. Worked for a year under Graebe at Geneva, and four and a-half years under Curtius at Heidelberg. Doctor Dissertation "Ein Beitrag Zur Kenntnis der Hydrazinate."

Thomas Callan.
H. Jermain Creighton.
Arthur W. Crossley.
M. O. Forster.
Alexander Scott.

Longman, Charles Herbert Bell,

32, Faringdon Street, Swindon, Wilts.

Lecturer in Chemistry, Tientsin Anglo-Chinese College, Tientsin, China. Student at the Royal College of Science, London, 1906–09, and obtained the Associateship of the Royal College of Science in Chemistry, 1909. Student at the Swindon Technical Institution Science Classes, 1903–06. Intermediate B.Sc. (London) 1905 in Chemistry, Physics and Mathematics. In conjunction with the Vice-Principal of the Tientsin Anglo-China College (J. B. Tayler, Esq., M.Sc., Victoria University, England, Member of the Society of Chemical Industry), we hope to take up research, more especially devoting our attention to native products, and desire to keep in touch with the work of investigators in other parts of the world.

Thomas Hartley.
Thomas C. Davison.
G. T. Morgan.
M. O. Forster.
James C. Philip.

Mason, Horace George,

The Grammar School, Kingsbridge, S. Devon.

Science Master at above School. Graduate (B.Sc. Hons. in Chemistry) of Manchester University. Have participated in research work, and desire to take the journals with a view to doing more research work, and also to keep in touch with the latest developments of chemistry.

W. H. Perkin.	H. C. H. Carpenter.
Ch. Weizmann.	V. J. Harding.
H. F. Coward.	A. N. Meldrum.

Needs, Francis Edwin,

7, Effingham Road, St. Andrew's Park, Bristol.

Chemical and Bacteriological Assistant in the State Medicine Laboratory, Bristol (1906–1910). Ex-Student in Chemical Department, Merchant Venturers' Technical College (1901). Late Assistant in the Wilts County Laboratory (1902–1906).

Edward Russell.	Chas. J. Waterfall.
Fredk. O'Brien.	F. Wallis Stoddart.

J. Wertheimer.

Knowles, Preston.

Newhaven, Camden Avenue, Feltham, Middlesex.

Analytical Chemist. Four years as Pupil with Public Analyst of Bolton; also Student of Electro-metallurgy at Municipal School of Technology, Manchester. Seven years' experience as Chemist—five years as Chief Chemist—in Electro-chemical Works.

Walter Ratcliffe.	A. W. Cowburn.
J. Harold Edge.	*James Porter Shenton.*

John E. Farmer.

The following Certificates have been authorised for presentation to Ballot by the Council, under Bye-law I (3):

Baume, Georges,

44, Quai des Eaux, Vives, Genève.

Privat-docent à l'Université, 1^{er} Assistant aux Laboratoires de Chimie Théorique et Technique de l'Université. Densité des gaz SO_2,$(CH_3)_2O$,CH_3Cl,CH_4,C_2H_6,H_2S. Compressibilité de quelques gaz aux basses pressions. Principe de 2 méthodes de détermination physicochimiques du froids moléculaire de gaz. Constants physicochimiques de quelques gaz liquéfiés. Courbes de fusibilité des mélanges gazeux aux basses températures. Publiés en grande partie *J. Ch. phys.*

H. Le Chatelier.	T. P. Hilditch.

William Ramsay.

Cardoso, Ettore,

Geneva, 3 Grand' Rue.

Assistant particulier au Laboratoire de Chimie-Physique (Directeur: Prof. Ph. A. Guye). Docteur-és-sciences (Grenoble). (1) Have published the following: "Recherches sur les compressibilités et les tensions de vapeur des mélanges d'oxyde de méthyle et d'acide sulfureux: formation d'une combinaison entre ces deux corps (*C.R.*, 1907, **144**, 911; with Dr. Briner); (2) Sur la liquéfaction et la compressibilité des mélanges gazeux; étude particuliére du cas où le mélange donne lieu à une combinaison" (*J. Ch. Phys.*, 1908, **6**, 641; with Dr. Briner); (3) "Densités orthobares de l'anhydride sulfureux" (*Arch. Sc. Phys. Nat. Gen.*, **28**, 392).

W. Spring. T. P. Hilditch.

William Ramsay.

Shah, Motilal Kashalchand,

Byculla Bridge, Byculla, Bombay, India.

Chemist and Manager, the Gujarat Candle Factory and Asbestos Works Company, Limited, Bombay, India. A detailed statement of Study, Service, Contribution to Science, Practice and Research, List of Awards and Testimonials, with extracts of opinions attached herewith.

Ruchi Ram Sahni.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK

Issued 14/5/10

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 26. No. 371.

Thursday, May 5th, 1910, at 8.30 p.m., Professor Harold B. Dixon, M.A., F.R.S., President, in the Chair.

Certificates were read for the first time in favour of Messrs. :

Middleton Henry Dand, Steyning, Sussex.
John Edward Hackford, B.Sc., 15, Burford Road, Nottingham.
Govind Laxman Joshi, 5, Argyle Avenue, Victoria Park, Manchester.
Frank Stevenson Long, B.Sc., 80, Tylney Road, Forest Gate, E.
Walter William Reed, M.Sc., 28, South Parade, Huddersfield.
John George Rose, Government Analytical Laboratory, Cape Town.
St. Clair Overbeck Sinclair, M.A., Government Analytical Laboratory, Grahamstown, Cape Colony.

A ballot for the election of Fellows was held, and the following were subsequently declared duly elected :

Georges Baume.
John Bethwaite.
Robert Benedict Bourdillon.
Oscar Lisle Brady, B.A.
Henry Leslie Farmer Buswell, B.A.
Ettore Cardoso, D.Sc.
Thomas Patrick Cheetham.
Herbert Edmund Clarke, B.Sc.
Thomas William Dickson, B.A.
Harry Farrands, M.A.
Charles Samuel Garland.
Harold Albert Goldsbrough.
Edwin Harrison.
William Jacob Jones, B.Sc.
James Kenner, Ph.D., B.Sc.
Sea-Kwain Kwoh.
Samuel Lamb.
Frederick Charles Lewis.
Charles Herbert Bell Longman.
Hubert Leslie Lucking, Ph.D.
Horace George Mason, B.Sc.
Francis Edwin Needs.
Knowles Preston.
Motilal Kashalchand Shah.

Of the following papers, those marked * were read :

*114. "The correlation of rock and river-water analyses."
By Henry Stanley Shelton.

The author called attention to the necessity of correlation between the analyses of rocks and of river-waters. Further remarks were added to what has already been published concerning the amount of sodium. Attention was also called to the large amount of sulphates shown in river-water analyses, and to the discrepancy between these analyses and those of the rocks which show a very minute proportion of sulphur. Some suggestions were made to analysts, with the view of explaining the discrepancy and of correlating these two departments of chemical work.

DISCUSSION.

Dr. DYER observed that river-water was largely drawn from surface drainage, and that surface soil necessarily contained sulphates, for sulphur was an integral constituent of the proteins in plants. The decay of plant residues in the soil and the consumption of crops by animals on the land must constantly produce sulphates. Farmyard manure contained plenty of sulphates.

Mr. J. PHELPS suggested that the large proportion of sulphur in river-water, compared with that in igneous and sedimentary rocks, might be due to the fact that water flows through the rocks chiefly along "faults," in which mineral veins, containing a much larger proportion of sulphur than the bulk of the rock, are frequently found ; and that river beds usually followed such geological formations.

Mr. SHELTON said that vegetation undoubtedly segregated some portion of sulphate, but it could not be regarded as an original source. Mr. Phelps's argument rather increased the difficulty than solved it, for it would imply that, in continents which had been upheaved for prolonged geological eras, no sulphide would remain. In reply to Mr. Baly, he remarked that organo-silicic acid would decompose into organic matter and silica. The circulation of organic matter he had not considered in detail. There were many ways in which an excess of oceanic carbonaceous matter could be returned to the land. Silica was undoubtedly deposited in large quantities over the greater part of the ocean floor. Dr. Colman's reference to the incrustation caused in boilers in which river-water had been used was a question that could only be settled by further investigation. It was not disputed that river-waters contained some sulphate. What proportion would account for boiler incrustation could not be determined without careful quantitative analysis.

*115. "The constitution and synthesis of caoutchouc."

By Samuel Shrowder Pickles.

In statements made recently by Klages and by Harries (*Chem. Zeit.*, 1910, **36**, 315), certain doubts have been expressed regarding the possibility of the polymerisation of isoprene into caoutchouc by the methods indicated by Tilden. These methods were of two characters, (1) the action of certain reagents (for example, an aqueous solution of hydrogen chloride) on isoprene, and (2) the slow spontaneous polymerisation of isoprene itself.

The latter method has been repeated by the author, and a white, rubber-like compound was produced, which gave derivatives like those obtained from natural caoutchouc, namely, the tetrabromide, $(C_{10}H_{16}Br_4)_x$, and the nitrosite.

The constitution of caoutchouc was discussed, objection being taken to the dimethyl*cyclo*octadiene formula. Other formulæ were proposed for caoutchouc and the ozonide which, the author considered, afford a better explanation of the properties and behaviour of these substances.

Discussion.

The President inquired whether the author had studied the ethyl analogue of isoprene.

Dr. Stevens inquired whether the author had extracted the substance obtained with acetone. This solvent would probably dissolve out most of the impurities, leaving the caoutchouc intact. He also drew attention to a statement made by Harries, namely, that *cyclo*-octadiene readily polymerises when warmed, to yield a caoutchouc-like substance. In all probability a series of derivatives existed, and this would explain the fact he (Dr. Stevens) had observed that the caoutchouc obtained from different latex-bearing trees varied in physical and chemical properties, however carefully it might be purified.

Dr. Pickles, in reply to the President, stated that, of the so-called derivatives of isoprene, one had been observed to have similar properties. Kondakoff had shown that methylisoprene ($\beta\gamma$-dimethyl-$\Delta^{\alpha\gamma}$-butadiene) underwent polymerisation to a rubber-like compound in a few months time. He (the speaker) had himself tried the experiment with dimethylisoprene ($\beta\delta$-dimethyl-$\Delta^{\beta\delta}$-pentadiene), but this did not appear to polymerise readily. The displacement of the hydrogen atoms attached to the terminal carbon atoms of isoprene by methyl groups apparently prevented or restrained polymerisation.

In reply to Dr. Stevens, Dr. Pickles said that the polymeride of isoprene, as at first precipitated, was more or less sticky. This was probably due, not to resin, but to the presence of hydrocarbons other than rubber. Natural rubber was similarly sticky and weak when first precipitated from solution in terpenes. Although Harries had obtained a rubber-like compound from the polymerisation of octadienes, he had not shown that it formed additive compounds of the type $C_{10}H_{16}Br_4$. Ethyl acrylate readily polymerised to rubber-like compounds, but in the process the double bond disappeared.

Replying to Dr. Forster, Dr. Pickles was of the opinion that, granting the possibility of residual affinities causing a kind of polymerisation in an unsaturated compound, those residual affinities should disappear when the compound became saturated, and therefore the bromide $C_{10}H_{16}Br_4$ should be a simple chemical molecule.

*116. "The constituents of the flowers of trifolium incarnatum." By Harold Rogerson.

The dried flowering tops of the carnation clover (*Trifolium incarnatum*, Linné), when extracted with alcohol and the resulting extract distilled in a current of steam, yielded a small amount of an essential oil, which contained furfuraldehyde, and possessed the following constants: d 20°/20° = 0·9597; a_D − 1°48′ in a 1-dcm. tube.

The portion of the alcoholic extract which was soluble in water contained a quantity of a sugar which yielded *d*-phenylglucosazone (m. p. 205—206°), and from the aqueous liquid the following definite substances were isolated: benzoic and salicylic acids in very small amount, with apparently a trace of *p*-coumaric acid; pratol, $C_{16}H_{12}O_4$; quercetin, $C_{15}H_{10}O_7$, and a new glucoside of the latter, $C_{21}H_{20}O_{12},3H_2O$ (m. p. 242—245°), which has been designated *incarnatrin*.

The portion of the alcoholic extract which was insoluble in water consisted chiefly of resinous material, but from it the following compounds were obtained: an alcohol, $C_{34}H_{69}OH$ (m. p. 72—74°), which had previously been obtained from the wax of the humble-bee, and which it is now proposed to designate *incarnatyl alcohol*; hentriacontane, $C_{31}H_{64}$; a phytosterol, $C_{27}H_{46}O$ (m. p. 135—136°; $[a]_D$ − 41·7°); trifolianol, $C_{21}H_{34}O_2(OH)_2$ (m. p. 295—300°; $[a]_D$ − 44·1°), and a mixture of fatty acids.

*117. "The triazo-group. Part XIII. Triazomethylcarbimide (triazomethyl *iso*cyanate)." By Martin Onslow Forster and Robert Müller.

Triazomethylcarbimide, $N_3{\cdot}CH_2{\cdot}N{:}C{:}O$, prepared by heating the triazoacetyl azide which arises from interaction of triazoacetyl chloride and sodium azide, boils at 44—45°/32 mm., and has sp. gr. 1·258/18°; it changes rapidly when heated into *tristriazomethyl isocyanurate*, $(N_3{\cdot}CH_2{\cdot}NCO)_3$, which melts at 153°. *Phenyltriazomethylcarbamide*, $C_6H_5{\cdot}NH{\cdot}CO{\cdot}NH{\cdot}CH_2{\cdot}N_3$, and *triazomethylcarbamide*,

$$N_3{\cdot}CH_2{\cdot}NH{\cdot}CO{\cdot}NH_2,$$

melt at 120° and 56° respectively.

In all these compounds the union between carbon and the triazo-group is so weakened by association with another atom of nitrogen that hydrazoic acid may be eliminated from them by the action of water.

118. "The absorption spectra of nicotine, coniine, and quinoline as vapours, liquids, and in solution." By John Edward Purvis.

The general results of an examination of the absorption spectra of nicotine, coniine, and quinoline are: (1) *N*/1000-alcoholic solution of nicotine exhibited an absorption band in the ultra-violet, showing its relationship to pyridine; the vapour of nicotine showed none of the series of narrow bands found by the author in pyridine; and liquid nicotine, like that of pyridine, showed no selective absorption.

(2) *N*/10-, *N*/100-, and *N*/1000-alcoholic solutions of coniine showed no bands of selective absorption in the ultra-violet, a result similar to that noticed by Hartley in solutions of piperidine; the vapour of coniine showed none of the series of bands found in the vapour of piperidine; and liquid coniine, like liquid piperidine, was remarkably transparent.

(3) *N*/1000-alcoholic solutions of quinoline exhibited three bands in the ultra-violet, as observed by Hartley; the vapour of quinoline had no narrow bands analogous to those found in benzene by Hartley, or to those in pyridine found by the author; and liquid quinoline showed no bands of selective absorption.

The results were compared with the previous results of the examination of the spectra of pyridine and its derivatives, and were discussed from a consideration of the constraint on the pulsations of the nucleus influenced by the side-chains and by their freedom of movement when existing as vapours, liquids, or in solution.

119. "Fluorones." By Frank George Pope and Hubert Howard.

Fluorone derivatives may be obtained by the oxidation of hydroxyphenylxanthen derivatives in alkaline solution in a current of air. The betaine ortho-quinonoid structure of Kehrmann was rejected, since phenylmethylfluorone is quite insoluble in alkali, and the opinion was expressed that Doebner's resorcinolbenzein is identical with hydroxyphenylfluorone, as was first pointed out by Kehrmann in 1908.

120. "Ionic equilibrium in solutions of electrolytes." By James Riddick Partington.

The dilution law for solutions of strong electrolytes referred to in a preliminary note (*Proc.*, 1910, 26, No. 365, 8) was considered in relation to the fundamental hypothesis of the ionising effect of moving ions, and a possible method of testing this hypothesis experimentally was suggested. The formula was contrasted with others previously obtained, and was shown to be applicable to the existing data for twelve typical binary electrolytes.

121. "Sodium succinates." By Hugh Marshall and David Bain.

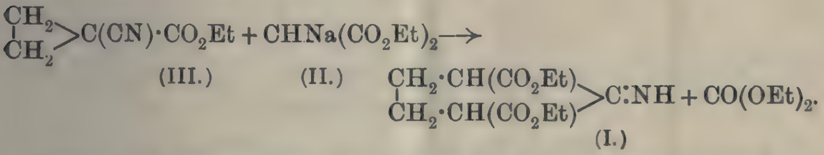
An examination of the sodium succinates and of the equilibrium-relationships in the system $Na_2C_4H_4O_4 : H_2C_4H_4O_4 : H_2O$ has been made in continuation of the work done on the potassium salts by Marshall and Cameron (*Trans.*, 1907, 91, 1519). The only salts obtained were: $NaHC_4H_4O_4,3H_2O$; $NaHC_4H_4O_4$; $Na_2C_4H_4O_4,6H_2O$; $Na_2C_4H_4O_4,H_2O$. With the exception of the last-mentioned, all of these had already been described. A solubility diagram has been made for the system, with isotherms for 0°, 25°, 50°, and 75°. Although no superacid salt was isolated corresponding with the potassium salt, $KH_3(C_4H_4O_4)_2$, the results seem to indicate the formation of some such salt in solution, since the quantity of extra succinic acid which passes into solution on the addition of a given quantity of sodium succinate is, at higher temperatures, considerably more than can be explained by the formation of the ordinary acid salt. (The addition of the acid salt itself increases the solubility of succinic acid.)

The transition points for the hydrated salts were determined dilatometrically, and solubility curves (0—75°) for the normal salt, the acid salt, and the acid itself have been drawn.

122. "The formation and reactions of imino-compounds." Part XII. The formation of imino-derivatives of *cyclo*pentane from open-chain mononitriles." By Alec Duncan Mitchell and Jocelyn Field Thorpe.

The authors showed that the formation of the five-carbon ring through the imino-group is not confined to open-chain dinitriles, but that mononitriles having a carbethoxyl group in the δ-position with respect to the nitrile group also pass readily into imino-derivatives of *cyclo*pentane. Thus *ethyl* 2-*imino*cyclo*pentane*-1 : 3-*dicarb-*

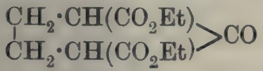
oxylate (I) is formed by the condensation of ethyl sodiomalonate (II) and ethyl 1-cyano*cyclo*propane-1-carboxylate (III), ethyl carbonate being formed at the same time :



$$\begin{array}{l}CH_2\\ CH_2\end{array}\!\!>C(CN)\cdot CO_2Et + CHNa(CO_2Et)_2 \longrightarrow \begin{array}{l}CH_2\cdot CH(CO_2Et)\\ CH_2\cdot CH(CO_2Et)\end{array}\!\!>C{:}NH + CO(OEt)_2.$$

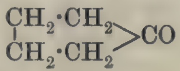
(III.) (II.) (I.)

Ethyl 2-imino*cyclo*pentane-1 : 3-dicarboxylate is at once hydrolysed by hydrochloric acid, yielding *ethyl* cyclo*pentan*-1-*one*-2 : 5-*dicarboxylate* (IV), from which either *cyclo*pentane (V) can be produced by acid hydrolysis, or adipic acid (VI) by the action of alkalis :



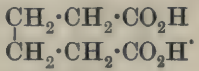
$$\begin{array}{l}CH_2\cdot CH(CO_2Et)\\ CH_2\cdot CH(CO_2Et)\end{array}\!\!>CO$$

(IV.)



$$\begin{array}{l}CH_2\cdot CH_2\\ CH_2\cdot CH_2\end{array}\!\!>CO$$

(V.)



$$\begin{array}{l}CH_2\cdot CH_2\cdot CO_2H\\ CH_2\cdot CH_2\cdot CO_2H.\end{array}$$

(VI.)

123. “New sensitive test for hydrocyanic acid.”

By James Moir.

The author having found the guaiacum test unsatisfactory, and the phenolphthalin-copper test sometimes inapplicable, has succeeded in finding a reagent which will detect hydrocyanic acid in a dilution approaching one part in five millions of water.

The test depends on the oxidation of a leuco-compound by nascent cyanogen resulting from the action of cupric copper on cyanides, but the author finds that none of the common leuco-compounds can be used.

The reagent is made by adding small quantities of copper acetate and acetic acid to a warm solution of hydrocœrulignone (tetramethoxydiphenol) in a large quantity of water, digesting the mixture at 50° for a few hours, and filtering. The solution to be tested is rendered faintly acid with acetic acid (using sodium acetate also if a “strong” acid is present), and then treated with about one-quarter of its volume of the reagent.

In solutions stronger than 1 in 100,000, an immediate crystalline precipitate of cœrulignone (red with purple lustre) is obtained ; with weaker solutions, a brick-red coloration. Oxidising substances must, of course, be absent, but most of them can be avoided by applying the test on paper exposed to the vapour evolved by the liquid to be tested, as in the guaiacum test.

A similar reaction is given by other tetra-substituted diphenols and by benzidine and its derivatives. Benzidine gives an indigo shade ; dianisidine, bluish-green, and tolidine, a green shade.

Although not so sensitive as hydrocœrulignone, these reagents are more trustworthy and keep much better. The colours produced are all derivatives of so-called diphenoquinhydrone.

124. "Changes in volume in the formation of dilute solutions." By Harry Medforth Dawson.

The changes of volume which occur in the formation of dilute solutions of iodine and naphthalene have been determined for fifteen different solvents at 18°. For these solvents the "solution volume" of one gram-molecule of iodine varies from 67·2 to 50·5 c.c.; that of one gram-molecule of naphthalene from 125·5 to 112·9 c.c. If the solvents are arranged according to the magnitude of the observed volume change, an entirely different sequence is obtained according to whether the dissolved substance is iodine or naphthalene. There appears to be no connexion between the internal pressure of the solvent and the "molecular solution volume" of the solute in the case of either of the dissolved substances, and the observed changes in volume cannot be interpreted in terms of the change in internal pressure which follows from the addition of the solute to the solvent. To explain the observations it seems necessary to admit that in many cases combination occurs between solvent and solute.

125. "Deninger's carbon monosulphide." By Frederick Percy Dunn.

In 1895 Deninger (*J. pr. Chem.*, [ii], **51**, 346) described the preparation of a gas obtained by the action of iodoform on silver sulphide, which he assumed to be the missing carbon monosulphide. Subsequent investigation has not confirmed his supposition. Russell and Smith (*Trans.*, 1902, **81**, 1538) studied Deninger's reaction, and obtained a reddish-yellow liquid having the characteristic odour of the alkyl sulphides, but failed to find any evidence of the existence of carbon monosulphide. At the same time their experiments gave no very precise indication as to what was the exact nature of the action of iodoform on silver sulphide.

From a preliminary study of the mutual behaviour of the two substances, it appeared not unlikely that the course of the reaction was really due to the decomposition of the iodoform by heat, and that the products of this change mutually reacted or were acted on by the silver sulphide.

The decomposition of iodoform was first studied by Hofmann (*Quart. Journ. Chem. Soc.*, 1861, **13**, 65), who found that on heating it for some hours in a sealed tube at 150°, and then distilling the product in a current of steam, methylene iodide was obtained, together with a brown residue, "the nature of which appeared anything but attractive." It was subsequently shown by Schmidt (*Arch. internat. Pharm. Therap.*, 1901, **8**, 110) that even at the temperature of boiling water, iodoform in the presence of air evolves iodine with the simultaneous formation of the two oxides of carbon.

By heating iodoform in a vacuous tube at 180° (the temperature at which Deninger heated his materials), it was found to be resolved into iodine, methylene iodide, carbon, a trace of hydrogen iodide, a very small quantity of a hydrocarbon, probably methane, as shown by the explosion results, and possibly traces of free hydrogen. Some portion of the methylene iodide was doubtless obtained by the action of hydrogen iodide on iodoform (Lieben, *Zeitsch. Chem.*, 1868, **4**, 712). By heating either iodoform or methylene iodide with silver sulphide, the reddish-yellow liquid described by Russell and Smith was obtained.

The course of Deninger's reaction appears to be mainly as follows: methylene iodide, formed by the decomposition by heat of the iodoform, acts on the silver sulphide with the formation of methylene sulphide, probably a lower polymeride of the compound obtained by Husemann (*Annalen*, 1863, **126**, 294) by the action of alcoholic sodium sulphide on methylene iodide.

Russell and Smith (*loc. cit.*) state with regard to the gas obtained from their experiment that "on explosion with oxygen about 6 per cent. of sulphur dioxide was formed, accompanied by more than five times that amount of carbon dioxide; this result is completely explained by the presence of the vapours of carbon disulphide and the reddish-yellow sulphide, and indicates that in the latter compound there are four or more carbon atoms to each atom of sulphur." This conclusion appears to be erroneous, since, as the silver sulphide and iodoform were heated in the presence of air, carbon dioxide and monoxide would be obtained (Schmidt, *loc. cit.*), together with a small quantity of a hydrocarbon, the presence of which was proved in the present experiments. Hence a certain proportion of the carbon dioxide obtained would be due to this circumstance.

The reaction between bromoform and silver sulphide was also studied, the products of the reaction being silver bromide, hydrogen sulphide, carbon, a small quantity of a solid alkyl sulphide, and a trace of free sulphur. Neither in the reaction between silver sulphide and iodoform nor in that between silver sulphide and bromoform was there found any trace of the solid polymeride of carbon monosulphide recently described by Dewar and Jones (*Proc. Roy. Soc.*, 1910, **83**, *A*, 526).

126. "The resolution of externally compensated acids and bases." By William Jackson Pope and John Read.

It was shown that when the resolution of an externally compensated acid (or base) is attempted by crystallisation with an optically active base (or acid), one of three different kinds of behaviour is to be observed. (1) The two salts, *d*B*d*A and *d*B*l*A, which are capable of formation, are readily separable by crystallisation, and show no tendency to form solid solutions one in the other; in this case an easy separation is effected by the method of Pope and Peachey. (2) The two salts, *d*B*d*A and *d*B*l*A, combine to form a partially racemic compound; in this case no resolution occurs. (3) The two salts, *d*B*d*A and *d*B*l*A, form solid solutions one in the other, and separation by fractional crystallisation is slow and very incomplete.

The resolution of externally compensated camphor-π-sulphonic acid by crystallisation with one-half an equivalent of strychnine, in accordance with Pope and Peachey's method, was readily effected, and forms a typical instance of behaviour of the kind (1). The resolution of 1-methyl*cyclo*hexylidene-4-acetic acid by crystallisation with brucine is very difficult to effect, owing to it presenting a case of the new type (3). The separation by crystallisation of *d*-bornylamine and *d*-*neo*-bornylamine *d*-α-bromocamphor-π-sulphonates and of *d*-menthylamine and *d*-*iso*menthylamine hydrochlorides also proved difficult, owing to the formation of solid solutions between the two component salts of the mixture.

127. "The interaction of alkyl halides and metals of the iron group." By James Frederick Spencer and Muriel Kate Harrison.

An attempt to ascertain whether metals of the sixth, seventh, and eighth groups could be caused to react with alkyl halides, after the manner of other metals (*Trans.*, 1908, **93**, 68, 1821; 1910, **97**, 385), led to the results described below, which, although in the main negative, show that there is no tendency on the part of these metals to form compounds of the type $R \cdot M'' \cdot X$.

Of the metals experimented with, namely, iron, cobalt, nickel, manganese, chromium, and molybdenum, only iron and nickel reacted with alkyl halides, and these only when heated in a sealed tube for several hours.

The reaction between the metals nickel and iron and iodobenzene takes place very completely, with the formation of diphenyl in extremely large yields, and constitutes a very good method for the preparation of this substance.

Nickel which has been freshly reduced from the oxide by means of hydrogen is mixed with iodobenzene out of contact with air, and heated in a sealed tube for several hours at 280°.

After cooling, the contents of the tube are distilled in a current of steam, and 85 per cent. of the theoretical quantity of diphenyl is obtained.

In the case of iron a similar reaction occurs at 180°, and the yield of diphenyl is 65 per cent. of the theoretical.

This reaction is not general, for, with the exception of *p*-iodotoluene, it could not be brought about in the case of any other halogen derivative.

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in June next. Applications for Grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, June 6th, 1910.

All persons who received grants in June, 1909, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Wednesday, June 1st.

The Council wish to draw special attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

ERRATUM.

Proceedings, 1910.

Page.	Line.	
107	16	*for* "**Knowles, Preston,**" *read* "**Preston, Knowles.**"

In consequence of the death of His Majesty King Edward, the Banquet to the Past Presidents of the Society, fixed for May 26th, has been postponed.

The Ordinary Scientific Meeting of the Society fixed for Thursday, May 19th, has been postponed until **Thursday,** May **26th,** 1910, at **8.30** p.m.

The following papers will be communicated:

"The constituents of the leaves of *Prunus serotina.*" By F. B. Power and C. W. Moore.

"Mechanism of tautomeric change." By H. T. Tizard.

"A new sulphide of nitrogen." By F. P. Burt.

"Volumetric estimation of manganese in manganese ores." By H. V. Krishnayya.

"Reactions of copper." By T. N. Das.

"Synthesis of 6-carboxy-3 : 4-dimethoxyphenylglyoxylic acid." By V. J. Harding and C. Weizmann.

"Note on the paper by Dr. A. Slator and Dr. H. J. S. Sand on 'The rôle of diffusion in fermentation by yeast cells.'" By H. T. Brown.

"The resolution of gnoscopine (*dl*-narcotine). Preliminary note." By W. H. Perkin and R. Robinson.

"The action of potassium chlorate on concentrated sulphuric acid. Preliminary note." By S. Smith.

"The products of diazotisation of the trinitro-*p*-anisidines." By R. Meldola and F. Reverdin.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 10/6/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. Nos. 372 and 373.

Thursday, May 26th, 1910, at 8.30 p.m., Professor Harold B. Dixon, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. O. L. Brady, T. W. Dickson, E. Hinks, W. E. S. Turner, and J. Young were formally admitted Fellows of the Society.

The President stated that the Council, at their Meeting held that afternoon, had sealed the following respectful Address of Condolence and Congratulation for presentation to his Majesty King George V. He moved that the Fellows of the Society should join with the Council in paying respect to the memory of the late illustrious King Edward VII and in offering homage to his Majesty King George V. This motion was seconded by Mr. C. E. Groves, and carried unanimously, the Fellows present all standing.

TO HIS MOST GRACIOUS MAJESTY KING GEORGE V.

May it please your Majesty

We, the President, Council and Fellows of The Chemical Society, most respectfully beg leave to approach your Majesty with an expression of our deepest sympathy in the great loss which your Majesty and the Empire have sustained in the death of His Most Gracious Majesty our late Sovereign Lord King Edward VII.

The Chemical Society will always bear in grateful remembrance the fact that a Royal Charter was granted to us by Queen Victoria, whose illustrious Consort took the deepest interest in the promotion of Science, and specially fostered the growth of Chemical Science in this country by the foundation of the Royal College of Chemistry.

We recall with gratitude the Royal welcome accorded last year by your Majesty, and her Majesty Queen Mary, to the Chemists of all Nations assembled in your Capital at the International Congress of Applied Chemistry.

We venture to hope that your Majesty's reign may see discoveries in Chemical Science no less brilliant and contributing no less to the welfare of your people than those which marked the reigns of your August Father and of Queen Victoria.

We beg leave to be permitted to offer to your Majesty this expression of our sincere congratulation on your accession to the Throne, and to assure your Majesty of our loyal devotion and of our earnest wish and prayer that your Majesty's reign may be long, happy and beneficent.

Signed on behalf of the Chemical Society,

(Signed) HAROLD DIXON, PRESIDENT,

L. S.

" ALEXANDER SCOTT, TREASURER,
" ARTHUR W. CROSSLEY,
" G. T. MORGAN, } HONORARY SECRETARIES,
" HORACE T. BROWN, { FOREIGN SECRETARY.

Dated this Twenty-sixth Day of May, One Thousand Nine Hundred and Ten.

The President made the following announcements:

(1) That owing to the death of his Most Gracious Majesty King Edward VII, the Banquet to Past Presidents had been postponed by the Council from May 26th to November 11th, 1910.

(2) That the following Resolution of Council had been communicated to Signor Cannizzaro, son of the late Honorary and Foreign Member, Professor Stanislao Cannizzaro:

The President, Officers, and Council of the Chemical Society have heard with deep regret of the death of Professor Stanislao Cannizzaro, the senior among their distinguished Honorary and Foreign Members.

All Chemists look back to the work of Professor Cannizzaro as one of the turning points in the progress of theoretical chemistry; and the

Fellows will ever bear in grateful memory the masterful exposition of his views given to the Society by the Faraday Lecturer of 1872.

The Council desire to express to the family of their late colleague the deepest sympathy in their loss.

(Signed) HORACE T. BROWN,
Foreign Secretary.

May 12th, 1910.

(3) That a fund was being collected to found a memorial to the late Professor Richard Abegg, the memorial to take the form of bursaries for students of Chemistry and Metallurgy at the University of Breslau.

Subscriptions to the fund would be received by the President or Sir William Ramsay.

(4) That the Council had invited Prof. Theodore W. Richards to deliver the Faraday Lecture during the next Session. The invitation had been accepted, and an announcement of the date of the Lecture would be made later.

Certificates were read for the first time in favour of Messrs.:

Ward Allen Batley, M.Sc., 197, Eccles New Road, Salford.
Ronald Leslie Collett, B.A., Little Dawley, Hayes, Middlesex.
Charles Frederick Guhlmann, Grantwood, Bergen Co., New Jersey, U.S.A.
Lionel Leslie Jacobs, Shelford, Beckenham, Kent.
William Ernest Martin, 111, Bellevue Road, Berea, Durban, Natal.
Benjamin Mason Narbeth, B.Sc., Durban Technical Institute, Durban, Natal.
Robert O'Field Oakley, 54, Sydney Road, Hornsey, N.
John Alexander Reddie, 3, Spring Gardens, Bradford, Yorks.
Ernest Stedman, B.Sc., 6, Breakwater Road, Bude, Cornwall.

Certificates of Candidates have been authorised by the Council for presentation to Ballot under Bye-law I (3) in favour of Messrs.:

Kaikhushroo Bamanji Sorabji, Secunderabad, Deccan, India.
John Williams, B.Sc., 122, Liddell Street, Invercargill, New Zealand.

Of the following papers, those marked * were read:

*128. "The constituents of the leaves of Prunus serotina." By Frederick Belding Power and Charles Watson Moore.

The material employed, consisting of the air-dried leaves of *Prunus serotina*, Ehrhart, yielded, on maceration with water, an amount of hydrogen cyanide equivalent to 0·0086 per cent. of its weight. The leaves contain a relatively small amount of *l*-mandelonitrile glucoside, together with an enzyme which hydrolyses β-glucosides. An alcoholic extract of the leaves, on distillation in a current of steam, yielded a very small amount of an essential oil, but no hydrogen cyanide. The non-volatile constituents of the leaves consisted of a green resin, insoluble in either hot or cold water, and material which remained dissolved in the aqueous liquid. The green resin, amounting to about 5·5 per cent. of the weight of the leaves, yielded hentriacontane, pentatriacontane, ceryl alcohol, palmitic, stearic, linolic and *iso*linolenic acids, a little ipuranol, $C_{23}H_{38}O_2(OH)_2$, and a new crystalline substance, $C_{31}H_{48}O(OH)_2$, melting at 275—277°, which has been designated *prunol*. The portion of the alcoholic extract which was soluble in water contained benzoic acid, quercetin, a new glucoside of quercetin, $C_{21}H_{20}O_{12},3H_2O$ (m. p. 245°), which has been designated *serotrin*, and *l*-mandelonitrile glucoside, together with a quantity of sugar and tannin. The aqueous liquid, after heating with dilute sulphuric acid, yielded, furthermore, *l*-mandelic acid, which had evidently been formed by the hydrolysis of the *l*-mandelonitrile glucoside.

*129. "The action of potassium chlorate on concentrated sulphuric acid." (Preliminary note.) By Stanley Smith.

The author has observed that at 338° the action of potassium chlorate on concentrated sulphuric acid is entirely unattended by explosive violence, the addition of the powdered salt to the boiling acid merely resulting in a brisk effervescence, with the production of chlorine, oxygen, and perchloric acid. The volume of oxygen evolved corresponds with about 90 per cent. of the total oxygen contained in the potassium chlorate, whilst the amount of perchloric acid formed appears to be very small.

This reaction was studied at various temperatures, and it was found that from 338° to 200° no crackling or detonation is produced. At 170°, however, the addition of potassium chlorate to sulphuric acid results in a number of small detonations, which increase in violence as the sulphuric acid is cooled and reach a maximum between 130° and

120°, when a sharp explosion results. Below 120° the violence of the action diminishes, until, at 60°, chlorine peroxide is quietly evolved without crackling or detonation.

DISCUSSION.

SIR WILLIAM RAMSAY suggested that the first action of sulphuric acid on potassium chlorate is the potential formation of chloric anhydride, Cl_2O_5. This decomposes into Cl_2 and 5O, and the oxygen is partly used in oxidising chlorine to perchloric acid. The usual equation, therefore,

$$3KClO_3 = KClO_4 + 2ClO_2 + K_2O$$

must be indeterminate.

The PRESIDENT asked whether Mr. Smith had ever obtained pure chlorine peroxide from a chlorate and sulphuric acid, as in his own experience he had always found that oxygen was given off in varying quantity as the change went on, and some free chlorine was liberated.

*130. "Mechanism of tautomeric change."

By Henry Thomas Tizard.

In all cases of tautomeric change where one form is more highly ionised than the other (including pseudo-acids and bases, besides substances like ammonium cyanate), the question arises, Is the change primarily due to the undissociated molecules or to the products of its dissociation? Both views have found support. Walker and Hambly thought that they had proved that the change of ammonium cyanate into carbamide was brought about by the interaction of the two ions NH_4 and CNO. Dimroth (*Annalen*, 1904, **335**, 1), on the other hand, held that in the case of his triazole derivatives only the undissociated part changed. Goldschmidt (*Zeitsch. Elektrochem.*, 1905, **11**, 5) showed that either hypothesis was tenable in all cases, for if the rate of change is proportional to the concentration of the undissociated part, it is also proportional to the product of the concentrations of the ions, and vice versa. Thus, if in the change of the ionisable XOH into HXO we find that

$$-\frac{dC_{XOH}}{dt} = k \cdot C_{XOH},$$

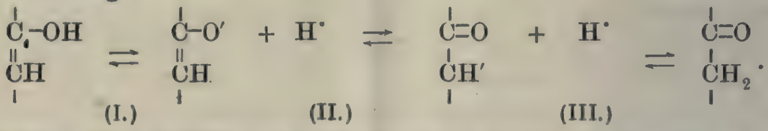
we also have

$$K \cdot C_{XOH} = C_X \cdot C_{OH},$$

and therefore

$$-\frac{dC_{XOH}}{dt} = \frac{k}{K} \cdot C_X \cdot C_{OH}.$$

Hence determination of rates of change affords no direct evidence in favour of either hypothesis. Indirect evidence of a kind can be obtained by changing the solvent. For instance, the degree of dissociation and rate of change of ammonium cyanate in water and in 90 per cent. alcohol have been determined; from the results it can be shown that if the change is due to the undissociated part, it is about eight times as fast in alcohol as in water; if to the ions, it is nearly one hundred times as fast. The former seems much more probable. Similar conclusions follow from Dimroth's work on the rate of change of the triazoles in various solvents. So, too, instead of changing the solvent, we can substitute a similar tautomeride of a different degree of dissociation. This method has been adopted by Sidgwick and Rivett (*Trans.*, 1909, **95**, 899). This argument, however, is not conclusive, and, indeed, there are many substances which change more rapidly the greater the ionising power of the solvent. It is then usual to assume that the change takes place by the interaction of the ions. Before we accept this view it might be as well to consider rather more closely what it involves. Such a change must take place in three stages:



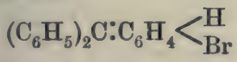
$$\begin{matrix} \mid \\ C{-}OH \\ \Vert \\ CH \\ \mid \end{matrix} \underset{\text{(I.)}}{\rightleftharpoons} \begin{matrix} \mid \\ C{-}O' \\ \Vert \\ CH \\ \mid \end{matrix} + H^{\cdot} \underset{\text{(II.)}}{\rightleftharpoons} \begin{matrix} \mid \\ C{=}O \\ \mid \\ CH' \\ \mid \end{matrix} + H^{\cdot} \underset{\text{(III.)}}{\rightleftharpoons} \begin{matrix} \mid \\ C{=}O \\ \mid \\ CH_2 \\ \mid \end{matrix}.$$

Of these, (I) and (III) are strictly ionic reactions, and therefore must be instantaneous. The slow change on which the whole velocity depends must therefore be (II), that is, the rearrangement of the anion. This must depend only on the concentration of the anion. The tautomeric change must thus be proportional, not to the product of the concentrations of the two ions, but to the concentration of the anion alone. If a mineral acid were added, the concentration of the anion, and therefore the rate of reaction, would diminish. In no single case investigated has this behaviour been found. Addition of hydrochloric acid invariably has an accelerating effect, and this is proportional to the increase in the product of the concentration of the two ions. The only way in which this difficulty can be overcome is by supposing that the second ion has a catalytic effect. The rate of change will then be proportional to the concentration of both ions. This is of course in agreement with facts, but it may well be doubted whether it offers a satisfactory or even a plausible explanation. If in all the reactions examined, the second ion were hydrogen, we might be compelled to admit the possibility of this peculiar catalytic action of one ion on another, but the phenomenon seems to be quite general, and entirely unconfined to one particular ionic species. Pseudo-bases, where the second ion is hydroxyl, behave exactly like pseudo-acids, and so do even such substances as ammonium cyanate and its analogues, where the second ion is ammonium or a substituted ammonium.

These considerations seem to show that in no case of tautomerism is it probable that the change is brought about directly through the ions, although the rate may of course be influenced by a factor which also influences the ionisation. The changing substance must always be the undissociated molecule.

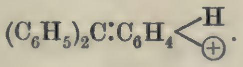
Discussion.

Dr. **Flürscheim** suggested that the tautomeric changes in the triphenylmethyl series might throw some light on the problem. The reactivity of some para-substituents in compounds, such as the triphenylmethyl halogenides, necessitated the assumption of a reversible change from the benzenoid to the quinonoid form. If this change occurred in the undissociated molecule, then, hydrogen being more mobile than halogen, tautomeric change of the quinonoid form (I) of unsubstituted triphenylmethyl bromide would produce *p*-bromotriphenylmethane. If, however, the change occurred in the ion, then, an electric charge being more mobile than hydrogen, tautomeric change of the quinonoid form (II) would give the original triphenylmethyl bromide.



$(C_6H_5)_2C{:}C_6H_4{<}\begin{matrix}H\\Br\end{matrix}$

(I.)



$(C_6H_5)_2C{:}C_6H_4{<}\begin{matrix}H\\\oplus\end{matrix}.$

(II.)

Since the latter alternative corresponded with experimental observation, the tautomeric change, in this case at least, must take place in the ion.

Dr. **Sidgwick** asked, with reference to Dr. Lapworth's remarks, how the catalytic effect of bases could be attributed to the formation of salts. The fact that in the case of nitrocamphor the effect of piperidine was so enormously greater than that of alkali seemed to show that some other factors were concerned.

*131. "A new sulphide of nitrogen." By Frank Playfair Burt.

When yellow nitrogen sulphide, N_4S_4, is sublimed in a vacuum over silver gauze heated to 100°, a small quantity of a blue substance is formed, although most of the nitrogen sulphide is deposited unaltered.

The blue substance has been shown by analysis to have the same percentage composition as the yellow sulphide.

Discussion.

The **President** inquired what was the temperature of the tube at the point where the blue sulphide was first formed, and whether the yield of the new sulphide was increased in the absence of the silver gauze.

Mr. Burt stated that the temperature of the tube where the blue sulphide first began to deposit was approximately that of the room. In the absence of silver gauze, no blue sulphide at all was formed.

*132. "The molecular complexity, in the liquid state, of amines, nitriles, and amides." (Preliminary note.) By William Ernest Stephen Turner and Ernest Wyndham Merry.

An investigation has been carried out, based on Ramsay and Shields's method, of the molecular complexities in the liquid state of thirteen amides and anilides, eleven nitriles and eleven amines.

In view of the quickened interest taken in the problem of solution, largely through the investigation, by Walden, of the solvent powers of organic media, including formamide, it was considered desirable to state that formamide exists, as a liquid, in a state of high molecular association. The association is, in fact, greater than in the case of water, and the authors suggest that the solvent action of formamide on salts, so similar to that of water, can be ascribed to the similar molecular complexity of the two substances.

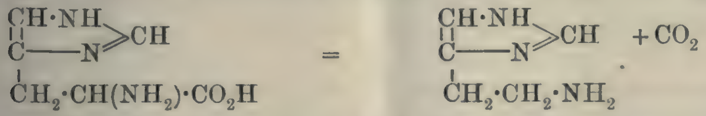
All the amides investigated exist in an associated state; of the nitriles, only those of the aliphatic series show association.

Primary amines are slightly associated. Substituted amines show a remarkable and interesting behaviour. The value of Ramsay and Shields's constant rises both with the number of hydrogen atoms substituted and with the weight of the substituting group. With tribenzylamine, the value of k is 3·50—3·60.

*133. "A third active principle in ergot extracts." (Preliminary note.) By George Barger and Henry Hallett Dale.

In addition to the active principles previously described by the authors as present in ergot and its extracts, namely, ergotoxine (*Trans.*, 1907, **91**, 337; *Biochem. J.*, 1907, **2**, 286) and *p*-hydroxyphenylethylamine (*J. Physiol.*, 1909, **38**, lxxvii; *Trans.*, 1909, **95**, 1123), there remained for identification the substance responsible for the intense activity exhibited by some ergot extracts in producing contraction of the isolated, *non-pregnant* uterus of the cat (compare Kehrer, *Arch. exp. Path. Pharm.*, 1908, **58**, 366).

As Kehrer found, this action is specially characteristic of Wernich's *Ergotinum dialysatum*. The relative abundance of this principle in dialysed extracts suggested that it was wholly or partly produced by micro-organisms, and this supposition was confirmed by physiological experiment. It was also found that commercial extracts of meat and of yeast have a similar activity in smaller degree. Applying Kutscher's method (*Zeitsch. Nahr. Genussm.*, 1905, **10**, 528; 1906, **11**, 582) for separating bases from meat-extract, the authors obtained the active principle from ergotinum dialysatum as a silver compound by adding silver nitrate in excess and then baryta. The hydrochloride of the physiologically active base, obtained from this silver precipitate, is readily soluble in cold methyl alcohol, less so in hot ethyl alcohol, and very sparingly so in cold ethyl alcohol. After suitable purification, a minute quantity of a crystalline picrate, melting at 220—230°, and a picrolonate, very sparingly soluble in boiling water and melting at about 250°, were obtained. The base regenerated from either salt had an intense action on the uterus, and gave Pauly's reaction with *p*-diazobenzenesulphonic acid. This, together with the conditions under which the base was precipitated by baryta in the presence of silver nitrate, suggested that it was a derivative of histidine. Histidine itself was found to be inactive, but acquired a trace of activity on heating, and became markedly so when exposed to putrefaction. It therefore seemed probable that the active base was β-iminazolylethylamine, produced from histidine



$$\begin{array}{l}\text{CH}\cdot\text{NH} \\ \| \qquad\qquad >\text{CH} \\ \text{C}\text{——}\text{N} \\ | \\ \text{CH}_2\cdot\text{CH}(\text{NH}_2)\cdot\text{CO}_2\text{H}\end{array} \quad = \quad \begin{array}{l}\text{CH}\cdot\text{NH} \\ \| \qquad\qquad >\text{CH} \\ \text{C}\text{——}\text{N} \\ | \\ \text{CH}_2\cdot\text{CH}_2\cdot\text{NH}_2\end{array} \quad + \text{CO}_2$$

by loss of carbon dioxide in the same way that *p*-hydroxyphenylethylamine in ergot extracts is produced from tyrosine.

This provisional identification is supported by the fact that the properties of the hydrochloride, picrate, and picrolonate above described correspond closely with those of the salts of β-iminazolylethylamine synthesised by Windaus and Vogt (*Ber.*, 1907, **40**, 369), and quite recently obtained by Ackermann (*Zeitsch. physiol. Chem.*, 1910, **65**, 504) by the putrefaction of histidine.*

134. "Volumetric estimation of manganese in manganese ores."

By H. V. Krishnayya.

The process consists of a combination of two well known methods, namely, the basic acetate separation of iron and the permanganate titration for manganese. The hydrochloric acid solution containing

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* Dr. Ackermann's kindness, which the authors gratefully acknowledge, has since enabled them to complete the identification by direct comparison of the base from ergot with that which he obtained by the putrefaction of histidine. In the crystalline form of their picrates, and particularly in their action on the uterus, the two bases were found to be identical.

0·2 gram of the ore is carefully neutralised with sodium carbonate, diluted to 400 c.c., and precipitated with 0·5 gram of sodium acetate. The boiling solution, without filtering off the iron precipitate, is then titrated with *N*/10-permanganate solution.

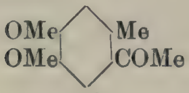
135. “Indirect estimation of copper.” By Tarak Nath Das.

Both copper and cupric sulphide dissolve in dilute sulphuric acid on boiling with excess of potassium chlorate.

A volumetric estimation of copper based on this reaction (as regards cupric sulphide) was suggested.

136. “Synthesis of 6-carboxy-3 : 4-dimethoxyphenylglyoxylic acid.” By Victor John Harding and Charles Weizmann.

By the condensation of acetyl chloride and homocatechol dimethyl ether, the authors have obtained 4 : *5-dimethoxy-*o*-methylacetophenone* (I). On oxidation with warm alkaline potassium permanganate this ketone gives 6-carboxy-3 : 4-dimethoxyphenylglyoxylic acid (II) (*Trans.*, 1902, **81**, 1022). The intermediate oxidation product (III) has also been isolated.



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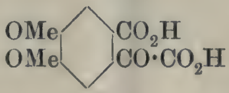

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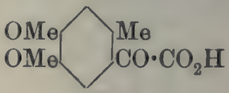
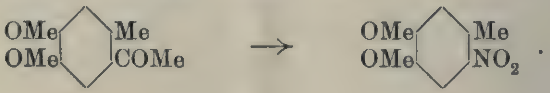


(III.)

When acted on by nitric acid, 4 : 5-dimethoxy-*o*-methylacetophenone gives nitrohomocatechol dimethyl ether, a direct displacement of the acetyl by the nitro-group occurring :



137. “Note on the paper of Dr. A. Slator and Dr. H. J. S. Sand on ‘the rôle of diffusion in fermentation by yeast-cells.’” By Horace T. Brown.

In the course of the discussion which followed the reading of the above paper (this vol., p. 85), the author expressed an opinion that provided the gradient of concentration of the sugar at the immediate surface of the yeast-cell is known, and also the amount of sugar fermented by a cell in unit of time, it should be possible to determine the minimal concentration requisite to supply the cell with its requirements by diffusion only by means of a simple mathematical treatment which renders it unnecessary to take into account the particular mode of diffusion within the cell itself.

On further consideration, and after discussing this point with Dr. Slator, the author has arrived at the conclusion that such a simplification of the problem would only be applicable if, at the limiting value of the concentration, the cell functions as a perfect absorber, that is to say, if the transformation of the sugar takes place at its immediate surface, which is almost certainly not the case. Under all other conditions, internal diffusion becomes a factor which has to be taken into account.

The authors of the paper are therefore correct in their statement that for the determination of the minimal concentration of a sugar solution which will just supply the cell with its requirements by diffusion only, it is necessary to make certain initial assumptions with regard to the distribution of enzyme within the cell.

138. "The resolution of gnoscopine (*dl*-narcotine)." (Preliminary note.) By William Henry Perkin, jun., and Robert Robinson.

The authors have succeeded in resolving gnoscopine by the fractional crystallisation of its *d*-bromocamphorsulphonate from ethyl acetate. The first fraction consisted mainly of *l-narcotine* d-*bromocamphorsulphonate*, which, after recrystallisation, melted and decomposed at 110—120° and had $[a]_D$ +97·2° in chloroform.

The second fraction consisted also mainly of this salt, and the mother-liquors, when left in the ice chest, deposited a large crop of crystals of *d*-narcotine *d*-bromocamphorsulphonate mixed with a quantity of the gnoscopine salt. The latter was removed by treatment with ethyl acetate, in which the *d*-narcotine salt is sparingly soluble, and, after crystallisation, the residue was found to be d-*narcotine* d-*bromocamphorsulphonate*, which melted at 170—185° and had $[a]_D$ −29·0° in chloroform. When liberated from their salts by treatment with alcoholic ammonia, the alkaloids exhibited the following properties in chloroform solution:

l-Narcotine from gnoscopine : $[a]_D$ − 199·8°.
d-Narcotine ,, ,, ,, + 199·9°.
l-Narcotine from opium ,, − 199·9°.

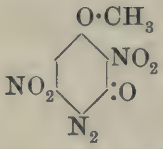
All these specimens melted at 174—175° (uncorr.).

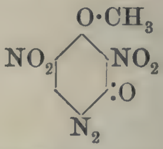
On mixing hot alcoholic solutions of *d*- and *l*-narcotine, crystals of gnoscopine, melting at 230°, separated at once. *d*-Narcotine had not previously been described, and the authors propose to submit it to physiological examination. A short time since (this vol., p. 46), the authors described a synthesis of gnoscopine from cotarnine and meconine, and as Salway (*ibid.*, 98) has lately synthesised the former substance, the synthesis of the inactive and active modifications of narcotine is now complete. The resolution of gnoscopine was rendered possible by the generosity of Messrs. T. and H. Smith, of Edinburgh, who placed 100 grams of this rare opium alkaloid at the authors' disposal. The authors are also indebted to Prof. W. J. Pope for the *d*-bromocamphorsulphonic acid required for this research.

139. "The products of diazotisation of the trinitro-*p*-anisidines."

By Raphael Meldola and Frédéric Reverdin.

The two isomerides, 2 : 3 : 5- and 2 : 3 : 6-trinitro-*p*-anisidine, both lose the 3-nitro-group on diazotisation, and give rise to the quinone-diazides:



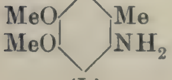


A description was given of these compounds and of their azo-β-naphthol derivatives. The results of the diazotisation of these trinitroanisidines, taken in conjunction with those of former researches, bring out very clearly the extreme mobility of the 3-nitro-group as compared with the methoxy-group under comparable conditions of displaceability.

140. "*m*-Hemipinic and asaronic acids." By Bernard Dunstan Wilkinson Luff, William Henry Perkin, jun., and Robert Robinson.

Although *m*-hemipinic acid is an acid of considerable importance, especially in connexion with researches on natural products, it is difficult to obtain in quantity, and the following experiments were instituted with the object of discovering a convenient method for its preparation. Creosol methyl ether is nitrated, and the resulting nitrocreosol methyl ether reduced by tin and hydrochloric acid to 4 : 5-*dimethoxy*-o-*toluidine* (I), which melts at 109°.

This amino-derivative is then converted by Sandmeyer's reaction into *dimethoxy*-o-*toluonitrile* (II), which melts at 81° and, on hydrolysis with barium hydroxide, yields dimethoxy-*o*-toluic acid (III), which has already been prepared by Perkin and Weizmann (*Trans.*, 1906, **99**, 1651). This acid is oxidised by alkaline permanganate quantitatively to *m*-hemipinic acid (IV).



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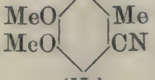

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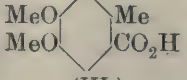

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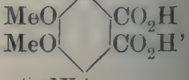
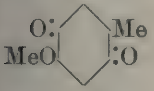


(IV.)

Considerable quantities of *m*-hemipinic acid have been prepared in this way, and the following observations were also made during the course of this research. Aminocreosol methyl ether (I) is readily oxidised by ferric chloride to 4-*methoxy*-2 : 5-*toluquinone* (V), which crystallises in golden spangles, melts and decomposes at 170—172°, and is reduced by sulphurous acid to the corresponding quinol (m. p. 123° ; VI). The latter is converted by methyl sulphate into 2 : 4 : 5-*trimethoxytoluene* (VII), which melts at 55° and, on oxidation with permanganate, yields asaronic acid (VIII).



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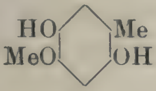

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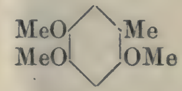
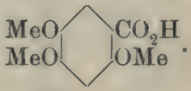
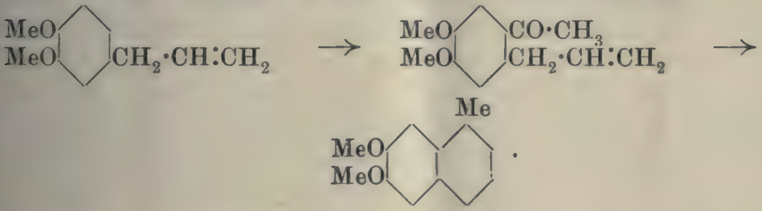


(VII.)



(VIII.)

When eugenol methyl ether is treated with acetyl chloride in the presence of aluminium chloride, a substance is produced which melts at 114°, and is evidently 6 : 7-dimethoxy-1-methylnaphthalene.



141. "The influence of radium emanation on equilibrium in a gaseous system : a correction." By Francis Lawry Usher.

The velocity-constant for the decomposition of ammonia by emanation has been recalculated from data already published (*Trans.*, 1910, **97**, 389).

142. "The intramolecular rearrangement of the halides of phenazothionium." By Harold James Page and Samuel Smiles.

It was shown that the chlorides of the simpler derivatives of phenazothionium are converted by the action of warm hydrochloric acid into the corresponding chloro-compounds of thiodiphenylamine. Displacement of hydrogen in the benzenoid systems of thiodiphenylamine by the nitro- and similar groups seems to hinder this reaction. The complete process of chlorination of thiodiphenylamine has thus been accomplished, the two intermediate products—the sulphoxide and phenazothionium salt—having now been isolated. The exhaustive chlorination of thiodiphenylamine may be carried out without isolating these intermediate compounds ; hydrogen dioxide and hydrochloric acid furnish tetrachlorothiodiphenylamine.

143. "A study of the Landsberger-Sakurai boiling-point method of determining molecular weights." By William Ernest Stephen Turner.

The author criticised the Landsberger-Sakurai method and its modifications, and described the nature and value of the corrections needed to make the method available for the determination of series of molecular weights at different dilutions. A simple form of apparatus whereby such determinations can be carried out was described.

The revised value, 39·0, of the molecular elevation of the boiling point of chloroform, recently given by Beckmann, has been confirmed.

144. "The salts of 8-hydroxyquinoline." By John Jacob Fox.

The salts of 8-hydroxyquinoline have been prepared and found to dissolve appreciably in benzene and chloroform. The copper, cadmium, and nickel salts are greenish-yellow, the remaining salts being yellow- or buff-coloured. The degree of hydrolysis of the sodium salt of 8-hydroxyquinoline and of the hydrochloride was determined by Farmer and Warth's method (*Trans.*, 1901, **79**, 863). It was found that in a 0·1*N*-solution the sodium salt was hydrolysed to the extent of 11·6 per cent., and the hydrochloride to the extent of 4·2 per cent.

8-Hydroxyquinoline and its salts, 8-ethoxyquinoline and its hydrochloride, 5 : 7-dibromo-8-hydroxyquinoline, and 8-hydroxy-1 : 2 : 3 : 4-tetrahydroquinoline and its hydrochloride were examined spectrographically in alcoholic solution. The yellow colour of the salts was shown to be due to the extension of the bands of the original substances into the visible region, the general form of the curves for absorption being similar in the derivatives of 8-hydroxyquinoline and its salts. The curves obtained from hydroxytetrahydroquinoline and its hydrochloride, were of a different character from that of hydroxyquinoline, and resembled those obtained from alkylated anilines.

145. "Apparatus for demonstrating the volumetric compositions of gases." By Alaric Vincent Colpoys Fenby.

The apparatus described was devised for the rapid demonstration of the combining volumes of gases and of the compositions of compound gases. The volumes of gases introduced are simple multiples of a *unit* volume (15 c.c.) equal to one division on the burette, which is divided into six parts. The pressure is adjusted to atmospheric pressure at each measurement, and no corrections for temperature or pressure are required.

The apparatus consists of four parts, namely, (1) the gas burette, of special design; (2) the levelling tube; (3) a reservoir for filling the burette, and (4) a special form of gas generator and holder, by which fixed volumes of a gas can be passed into the burette. The whole is conveniently supported on a single retort stand.

The use of the apparatus for the following experiments was described: Composition of ammonia by the chlorine method; combination of hydrogen and chlorine in equal volumes; combining volumes of hydrogen and oxygen; the composition of carbon monoxide and hydrocarbon gases, and the decomposition of hydrogen chloride by sodium amalgam.

Special features of the apparatus include the generation of chlorine in the burette; the method of introducing fixed volumes of gas into the burette from the generator, and the construction of the generator itself and the burette.

146. "Some reactions of benzyl mercaptan. Benzyl tri- and tetrasulphides." By John Armstrong Smythe and Aquila Forster.

When a solution of benzyl mercaptan in glacial acetic acid is saturated with sulphur dioxide and hydrogen chloride, a quantitative reaction takes place according to the equation:

$$4C_6H_5\cdot CH_2\cdot SH + SO_2 = (C_6H_5\cdot CH_2)_2S_2 + (C_6H_5\cdot CH_2)_2S_3 + 2H_2O.$$

Benzyl trisulphide melts at 49°, and possesses considerable crystallising powers. It forms a sparingly soluble *additive product*,

$$(C_6H_5\cdot CH_2)_2S_3,AgNO_3$$

(m. p. 96°), with silver nitrate. The action of sulphur dioxide on benzyl mercaptan thus resembles that of thionyl chloride on mercaptans (Holmberg, *Annalen*, 1907, **359**, 81), and the results throw some light on Jones and Tasker's work (*Trans.*, 1909, **95**, 1910).

Benzyl mercaptan and benzyl disulphoxide condense in the presence of glacial acetic acid and a current of dry hydrogen chloride, water being formed, the disulphoxide reduced to disulphide, and the mercaptan oxidised to disulphide:

$$(C_6H_5\cdot CH_2)_2S_2O_2 + 4C_6H_5\cdot CH_2\cdot SH = 3(C_6H_5\cdot CH_2)_2S_2 + 2H_2O.$$

Similarly, benzyl disulphoxide in the presence of glacial acetic acid and dry hydrogen chloride condenses with hydrogen sulphide, forming benzyl disulphide, water, and sulphur:

$$(C_6H_5\cdot CH_2)_2S_2O_2 + 2H_2S = (C_6H_5\cdot CH_2)_2S_2 + 2H_2O + S_2.$$

These condensations are quantitative.

Benzyl sulphoxide does not condense in this way when sodium ethoxide or acetic anhydride are used as condensing agents.

Benzyl tetrasulphide, together with hydrogen chloride, is formed by the interaction of benzyl mercaptan and sulphur chloride, thus:

$$2C_6H_5\cdot CH_2\cdot SH + S_2Cl_2 = (C_6H_5\cdot CH_2)_2S_4 + 2HCl.$$

The new sulphide is a white, crystalline powder, soluble in alcohol, benzene, etc., insoluble in water, and melting at 49—50°. It forms no additive products with methyl iodide or with silver nitrate. Nascent hydrogen reduces it, giving benzyl mercaptan and hydrogen sulphide, and chlorine attacks it in the cold with the formation of sulphur chloride and benzyl chloride. In glacial acetic acid solution it is oxidised by hydrogen peroxide.

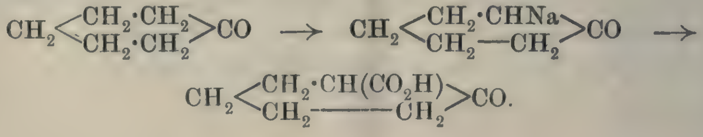
147. "The action of sodium or potassium hydroxides on sodium alkyl thiosulphates and on disulphides." By Thomas Slater Price and Douglas Frank Twiss.

The authors referred to the criticism by Fromm and Erfurt (*Ber.*, 1909, **42**, 3816) of their explanation of the course of the reaction between alkalis and the sodium alkyl thiosulphates, and pointed out that there is no satisfactory experimental evidence for the formation of intermediate compounds of the type R·S·OH, postulated by Gutmann (*Ber.*, 1908, **41**, 1650) and favoured by Fromm and Erfurt.

In connexion with the action of alcoholic potassium hydroxide on benzyl disulphide, it was shown that if benzyl chloride is added to the mixture after the reaction has taken place, and the mixture again heated, the main products are benzyl sulphide and benzoic acid, whereas if benzyl chloride is present from the commencement, a considerable quantity of the benzylmercaptal of benzaldehyde is also formed. From these results it was deduced that the primary result of the action of alkali on benzyl disulphide is the formation of benzyl mercaptan and benzoic acid.

148. "Carboxylic acids of *cyclo*hexanone and some of its derivatives." (Preliminary note.) By Henry Dent Gardner, William Henry Perkin, jun., and Hubert Watson.

These acids are obtained when the cyclic ketones are treated, in ethereal solution, with sodamide and carbon dioxide.



$$CH_2<\begin{matrix}CH_2\cdot CH_2\\CH_2\cdot CH_2\end{matrix}>CO \rightarrow CH_2<\begin{matrix}CH_2\cdot CHNa\\CH_2-CH_2\end{matrix}>CO \rightarrow$$

$$CH_2<\begin{matrix}CH_2\cdot CH(CO_2H)\\CH_2-CH_2\end{matrix}>CO.$$

cyclo*Hexanone-2-carboxylic acid* softens at 79°, melts and decomposes at 81—82°, and, on reduction with sodium amalgam, yields *cyclo*hexanol-2-carboxylic acid (hexahydrosalicylic acid), which melts at 111°.

1-*Methyl*cyclo*hexan-2-one-3-carboxylic acid* is a syrup.

d-1-*Methyl*cyclo*hexan-3-one-2(?)-carboxylic acid*, prepared from 1-methyl*cyclo*hexan-3-one from pulegone, melts at 103°, and has $[\alpha]_D + 97\cdot2°$. *dl*-1-*Methyl*cyclo*hexan-3-onecarboxylic acid*, prepared from *dl*-1-methyl*cyclo*hexanone, melts at 100°.

1 *Methyl*cyclo*hexan-4-one-3-carboxylic acid* melts at 101°, and, on reduction with sodium amalgam, yields 1-*methyl*cyclo*hexan-4-ol-3-carboxylic acid*, which melts at 114° and, when heated, yields a *methyl*cyclo*hexenecarboxylic acid*, which distils at 153°/25 mm. and crystallises. This acid is being investigated with the object of determining the position of the double linking.

Menthonecarboxylic acid melts at 154°, and *thymomenthonecarboxylic acid* at 150—151°.

All those acids which contain the grouping $\cdot CO\cdot CH\cdot CO_2H$ give intense colorations when ferric chloride is added to their alcoholic solutions.

Thursday, June 2nd, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. W. P. Bloxam and Hubert L. Lucking were formally admitted Fellows of the Society.

Of the following papers, those marked * were read:

*149. "The interaction of nickel carbonyl and carbon disulphide."

By Sir James Dewar and Humphrey Owen Jones.

Nickel carbonyl and carbon disulphide vapours interact readily at the ordinary temperature to form carbon monoxide and a bronze-coloured deposit containing nickel, sulphur, and carbon; the liquids, on the other hand, interact only to a very slight extent.

An examination of the volume changes when the two vapours are allowed to react in a specially devised apparatus shows that the reaction is probably represented by the equation (II) rather than (I):

$$2Ni(CO)_4 + CS_2 = 2NiS + 8CO + C \quad . \quad . \quad . \quad (II)$$

$$Ni(CO)_4 + CS_2 = NiS + 4CO + CS \quad . \quad . \quad . \quad (I).$$

The reaction, however, is incomplete, proceeds more extensively at low pressures than at higher pressures, and is completely inhibited by the presence of carbon monoxide of a sufficient concentration. Thus, for example, there is no change in a mixture containing nickel carbonyl vapour under 37·5 mm., carbon disulphide vapour under 32·5 mm., and carbon monoxide under 68·5 mm. pressure.

In order to account for the influence of carbon monoxide on the reaction, and for the fact that the reaction, although not reversible, is incomplete, it is suggested that the actual reaction takes place, not between molecules of nickel carbonyl and carbon disulphide, but between free nickel produced by the dissociation of nickel carbonyl and carbon disulphide. The initial concentration of free nickel in the vapour of nickel carbonyl would be small, and would be much reduced by the presence of carbon monoxide, to which the dissociation of nickel carbonyl is very sensitive. Consequently, the presence of carbon monoxide would tend to inhibit the reaction until it would finally come to standstill.

DISCUSSION.

The PRESIDENT asked whether it was not *nascent* nickel that reacted with the carbon disulphide vapour. Had the authors observed whether the vapour of nickel carbonyl showed appreciable dissociation throughout its mass when admitted to a vacuous bulb, or whether the dissociation only took place in contact with the glass surface ?

Dr. JONES replied that the behaviour of nickel carbonyl vapour at low pressures indicated that dissociation takes place in contact with the glass surface, and the interaction with carbon disulphide appeared to take place similarly.

*150. "Synthesis of cotarnine." By Arthur Henry Salway.

The author described in detail an investigation, of which a preliminary account has recently been given (this vol., 98).

DISCUSSION.

In reply to Dr. Barger, Dr. SALWAY pointed out that the synthesis of cotarnine is complete, since myristicinaldehyde has been prepared by the author from myristicinic acid, which in turn is readily obtained from cotarnic acid (Roser, *Annalen*, 1889, **254**, 348). The synthesis of cotarnic acid has already been accomplished (Perkin, Robinson, and Thomas, *Trans.*, 1909, **95**, 1977).

*151. "The accuracy of the gold bullion assay." By John Phelps.

The author has examined a number of results obtained in the assay of gold bullion from the point of view of the probable error.

The following points were considered:

1. Gold assays made in the course of routine work in the assay department of the Royal Mint.

2. (*a*) Assays of "trial plates" and comparisons of samples of "proof" gold; (*b*) Comparison of proof gold made in the Mint laboratory with that produced by the Utrecht Mint.

3. Comparison of the results of assays made at the Royal Mint with the results of other assayers working on the same material.

4. Discussion on the same lines of results recorded in a paper by F. P. Dewey ("The Assay and Valuation of Gold Bullion," *Trans. Amer. Inst. Mining Engineers*, 1909).

The author finds that ordinary gold assays weighed to 0·05 per 1000 are subject to a probable error of ± 0·043 per 1000, while in the case of special assays weighed to 0·01 per 1000, the probable error of a single assay may be reduced to ± 0·032 per 1000.

From this it is concluded that the error in the mean of 20 assays made with the greatest care should not exceed 0·01 per 1000.

*152. "Morphological studies of benzene derivatives. Part I. Introductory." By Henry E. Armstrong.

The studies referred to were instituted with the object of ascertaining the general and particular effect of alterations in molecular structure—especially of alterations in the orientation in the molecule of similar radicles—on crystalline form in the case of the extensive series of isomeric tri-derivatives obtained on introducing two like or unlike halogen atoms and the sulphonic radicle in its various forms into benzene. The plan of the work was explained and a general account was given of the course it has taken. The inquiry has been prosecuted in the author's laboratory during the past fifteen years but the significance of the results arrived at has been apparent only since the development of the Barlow-Pope theory of the interconnexion of external crystalline form and internal molecular structure: the results appear to afford singular confirmation of the theory.

*153. "Morphological studies of benzene derivatives. Part II. Sulphonic derivatives of the 1:4-di-derivatives of benzene containing halogens." By Reginald Thomas Colgate and Ernest Harry Rodd.

Twenty-seven compounds of the 1:4-series have been measured: the results were fully reported and discussed. The sulphonic chlorides and bromides fall into the one or the other of two crystallographic series; one or two cases of dimorphism have been observed, however, which connect the two series; the connexion is further established by the fact that in some cases the sulphonic chloride crystallises in the one series whilst the corresponding bromide crystallises in the other, although, as a rule, there is very close resemblance between corresponding sulphonic chlorides and bromides. The sulphonanilides and the ortho-, meta- and para-toluidides also form an isodimorphous group; in most cases they are obtainable in a labile as well as in a stable form.

It was shown that all the compounds described can be arranged in one or the other of two series, one derived from the hexagonal, the other from the cubic mode of packing equal spheres—the two alternative modes which Barlow and Pope have shown to be possible in the case of benzene units. The results afford most striking evidence of the maintenance of a benzene framework in the molecules.

*154. "Behaviour of two salts with a common ion, when dissolved in an organic solvent." By James Charles Philip and Harold Reuben Courtman.

The conductivity of solutions of tetraethylammonium iodide and potassium iodide, separately and together, in methyl and ethyl alcohols, methyl ethyl ketone, acetonitrile, and nitromethane has been determined at 25°. The examination of the separate salts has shown that between $v=50$ and $v=2000$ the equivalent conductivity is a linear function of the cube root of the concentration; that is, the empirical rule, $\lambda=\lambda_{\infty}-a\sqrt[3]{\eta}$, formulated by Kohlrausch for binary salts in aqueous solution, may be taken as valid also for these salts in organic solvents. On the basis of this rule it is possible by Barmwater's method to calculate the conductivity of a solution containing two salts with a common ion, on the assumption that in the mixture each salt behaves as if it were present alone at a concentration equal to the sum of the concentrations of the two salts. The agreement between the observed and calculated values is such as to suggest that the relation of two salts with a common ion in an ionising organic solvent is closely similar to the relation existing between them when dissolved in water.

Discussion.

Dr. Philip, in reply to a question, said that the differences between the observed and calculated values for the conductivity of the mixed iodides were greater than the experimental errors. Formamide had not been tried as a solvent. Like water, it was characterised by a high dissociative power, and for such solvents the differences between the values for the conductivity of the mixed salts calculated by Barmwater's method and those calculated on an additive basis were considerably less than in solvents of weaker ionising power.

155. "The effect of contiguous unsaturated groups on optical activity. Part VI. The influence of molecular symmetry. Application to the relative rotatory powers of position-isomerides." By Thomas Percy Hilditch.

It was shown that, in an optically active compound completely symmetrical with respect to the geometrical centre of its molecule and containing at the same time adjacent unsaturated radicles, there usually exists a very anomalous degree of rotatory power. The direction of the anomaly (positive or negative) is not always the same, and, in particular, negative effects frequently occur when two or more unsaturated groups are in spacial proximity. Similar, but less pronounced, phenomena accompany the presence of partial molecular symmetry coupled with unsaturation.

This effect, together with that due to the conjunction in space of two unsaturated groups (*Trans.*, 1909, **95**, 1577), appears in some measure to explain the deviations frequently observed from Guye's hypothesis (in its simplest qualitative form) in the rotatory powers of optically-active position-isomerides. By utilising derivatives of trisubstituted benzene compounds (such as the phenolic camphor-β-sulphonates) it has been possible to differentiate between the maximum effects due respectively to symmetry (1 : 3 : 5-isomeride) and to the influence of mass (1 : 3 : 4-isomeride), both of which are concentrated in the para-derivative in disubstituted compounds.

156. "The action of Grignard reagent on camphoric and *iso*camphoric esters." By Yūji Shibata.

The author has recently shown (*Trans.*, 1909, **95**, 1449) that the action of the Grignard reagent on phthalic esters results in the formation of derivatives of phthalide or those of phthalan, whilst glycols are produced from succinic and terephthalic esters, and the conclusion was drawn that the two CO_2R groups in phthalic esters are in the *cis*-position, whilst those in succinic and terephthalic esters are in the *trans*-position. In order to obtain further confirmation of this view, the author has now examined the action of the Grignard reagent on camphoric and *iso*camphoric esters, these being definitely known to be *cis-trans*-isomerides. In accordance with the anticipation, dimethyl camphorate, an ester of the *cis*-acid, gave campholides, whilst dimethyl *iso*camphorate, an ester of the *trans*-acid, gave the non-condensed ester of diphenylhydroxy*iso*campholic acid. By the action of magnesium *iso*propyl iodide on dimethyl camphorate, a substance, $C_{14}H_{24}O_3$, probably methyl 1 : 2 : 2-trimethyl-3-*iso*butyryl*cyclo*pentane-1-carboxylate, was obtained. The author also discussed the constitution of dimethylcampholide obtained by G. Komppa (*Ber.*, 1908, **41**, 1039).

157. "Some aromatic antimony compounds." (Preliminary note.)
By Percy May.

By the action of hot fuming nitric acid on triphenylstibine, Michaelis and Reese (*Annalen*, 1886, **233**, 52) obtained triphenylstibine nitrate, $(C_6H_5)_3Sb(NO_3)_2$, melting at 156°. The author has, however, succeeded in nitrating the benzene nuclei of triphenylstibine, and has obtained a well crystallised *trinitro*-derivative melting at 191°. This, on reduction with zinc dust and glacial acetic acid, yields the corresponding amino-compound, which can be recognised by the usual tests, but has not yet been isolated in the pure condition. A very small quantity of *tri*-p-*aminophenylstibine* has, however, been obtained by the action of sodium on a solution of antimony trichloride and *p*-chloroaniline in benzene solution. The extreme smallness of the yield is not surprising, as an insoluble compound is formed when a benzene solution of antimony chloride is added to a solution of *p*-chloroaniline in the same solvent, the formation of which tends to prevent the reaction from proceeding. Analysis indicates that this compound is formed by the union of one molecule of antimony chloride with one of chloroaniline. Antimony chloride does not appear to form similar compounds with aniline or with *p*-chlorophenol.

An attempt has been made to sulphonate triphenylstibine, and although it was evident that sulphonation had taken place, no pure compound has, as yet, been isolated from the reaction product.

It is proposed to prepare other substituted derivatives of triphenylstibine by the method indicated above, and also to study the derivatives of the amino-compound.

158. "Note on the cobaltinitrites."
By Mary Cunningham and Frederick Mollwo Perkin.

In a recent paper (*Trans.*, 1909, **95**, 1562), the authors gave a method for the preparation of sodium cobaltinitrite which was found to furnish the best results. Prof. E. Biilmann points out that an almost identical method has been previously described by him. The authors regret that, in searching the literature, the communication of Prof. Biilmann had escaped their attention.

159. "Acetone derivatives of *d*-fructose."

By James Colquhoun Irvine and Charles Scott Garrett.

The condensation of fructose with acetone gives three fructosemonoacetones, two of which, on continued action, condense with a second molecule of the ketone, giving rise to the α- and β-fructosediacetones previously described by Fischer. The formation of these three isomerides was explained on stereochemical grounds, and necessitates an extension of the nomenclature of sugar derivatives.

α-Fructosemonoacetone was obtained by the partial hydrolysis of α-fructosediacetone by the action of 0·1 per cent. of hydrogen chloride at 30°. Under these conditions only the non-glucosidic acetone residue is removed. The compound melts at 120—121°, and gave $[\alpha]_D^{20°}$ – 158·9° in aqueous solution. *β-Fructosemonoacetone* was obtained as a syrup, and was identified by analysis and by the formation from it of β-fructosediacetone. The third monoacetone compound is incapable of further condensation, and was characterised by conversion into trimethyl fructosemonoacetone(b. p. 120°/15 mm.) by the silver oxide reaction.

The α- and β-fructosediacetones have been further examined. The compounds show a remarkable difference in their behaviour towards hydrolytic agents. In each case the non-glucosidic group is the first to be removed, and this takes place with the α-compound under conditions towards which the β-isomeride is perfectly stable.

160. "The absorption spectra of 1 : 4-dihydronaphthalene and 1 : 2 : 3 : 4-tetrahydronaphthalene." By Alfred Godfrey Gordon Leonard.

Bamberger has shown that when reduction is confined to one of the nuclei in the naphthalene molecule, the properties of the compounds so produced are in close agreement with those of analogous benzene derivatives. These substances have been examined to ascertain if there might be any similar relationship between their respective absorption spectra, and the following conclusions are drawn: (1) The curves of 1 : 4-dihydronaphthalene and 1 : 2 : 3 : 4-dihydronaphthalene are similar, and occupy a position intermediate between the curves of naphthalene and *o*-xylene.

(2) The spectra are those of a benzenoid nucleus as modified by the presence of an aliphatic ring.

(3) Such spectra are in close agreement with the observed chemical properties of the two hydrides.

161. "The determination of malonic acid by potassium permanganate." By Alexander Thomas Cameron and Basil Charles McEwan.

In order to extend the observations of Marshall and Cameron on the succinates (*Trans.*, 1907, **91**, 1519) to the corresponding malonates, it was necessary to find a conveniently simple method for the quantitative estimation of malonic acid. Durand (*Ann. Chim. anal.*, 1903, **8**, 330) states that malonic acid can be estimated with potassium permanganate in acid solution at 80°, the formic acid, which is one of the products, reacting with the permanganate so slowly that a definite end point can be obtained. He writes the reaction as:

$$C_3H_4O_4 + 3O = H_2O + H_2CO_2 + 2CO_2 . \quad . \quad . \quad . \qquad (1).$$

Concentrated solutions of malonic acid and malonates decompose on boiling, with rapid evolution of carbon dioxide and production of acetic acid. Lamoureux (*Compt. rend.*, 1899, **128**, 998) states that this reaction commences at 68°. Any method requiring a temperature of 80° can evidently only be applied to dilute solutions.

Using Durand's original method, the authors have never obtained a definite end-point; this is due presumably to the slow but steady oxidation of the formic acid. On the other hand, the truth of the above equation can be easily shown qualitatively. When a dilute solution of malonic acid is distilled with acid permanganate, carbon dioxide is evolved, and the distillate contains formic acid.

An attempt was made to reduce the oxidation of the formic acid to a minimum by heating the malonic acid with excess of permanganate for a few minutes, reducing the permanganate remaining with oxalic acid, and titrating the excess of oxalic acid with more permanganate. According to equation (1), 1 gram of malonic acid is oxidised by 1·823 grams of potassium permanganate. In nine titrations the corresponding figure varied from 1·933 to 2·205 grams, showing no regularity.

If complete oxidation of the malonic acid took place, as expressed by the equation:

$$C_3H_4O_4 + 2O_2 = 2H_2O + 3CO_2 \quad . \quad . \quad . \quad . \qquad (2),$$

1 gram of malonic acid would require 2·431 grams of permanganate. The actual results lie between the two figures, and it is evident that the method is inapplicable owing to the oxidation of an indeterminate amount of formic acid.

Formic acid is immediately oxidised by hot alkaline permanganate, whilst under the same conditions malonic acid is very slowly attacked;

hence complete oxidation of the malonic acid can be brought about by first heating with excess of acid permanganate, and then rendering the whole alkaline with excess of alkali.

This method was tested in the following manner. Either a weighed quantity of solid or (where the weight is given in brackets) a measured volume of standard solution of malonic acid was added to approximately 2*N*-sulphuric acid, excess of permanganate solution added, and the whole heated to 80—90° for ten minutes (or longer with the more dilute solutions); the solution was then rendered alkaline with strong aqueous potassium or sodium hydroxide, and the heating continued for some minutes; finally, excess of sulphuric acid was added, then for convenience excess of oxalic acid, and this excess determined with more permanganate.

The results are given below:

No. of experiment.	Weight of malonic acid.	Grams malonic acid per litre solution.	Grams $KMnO_4$ per gram malonic acid.
1	(0·2004)	2·85	2·382
2	(0·2000)	1·42	2·431
3	0·1942	1·30	2·449
4	(0·2000)	1·25	2·451
5	0·1850	1·23	2·449
6	0·1682	1·12	2·419
7	0·1544	1·03	2·430
8	(0·2100)	0·66	2·453
9	(0·2048)	0·43	2·125
10	(0·2048)	0·40	2·481
		Theory	2·431

The figures show that the explanation given is the correct one. At the same time they indicate the limits of dilution (calculated on the concentration at the commencement of the reaction) within which the method can be employed quantitatively. In the first experiment some decomposition of the malonate through heat has already taken place, whilst in the last two the results are uncertain. Further experiments on similar lines have indicated that to obtain accurate results it is essential to work below 90° (the reaction commences at about 70°, and proceeds rapidly between 80° and 85°) and to avoid great excess of sulphuric acid.

Mestrezat (*Ann. Chim. anal.*, 1907, **12**, 173) states that tartaric and malic acids react with potassium permanganate in the same manner, with the production of formic acid and carbon dioxide. He suggests a similar method for their estimation.

The case of citric acid (Wöhlk, *Zeitsch. anal. Chem.*, 1902, **41**, 77) is more complex, but the reaction proceeds on corresponding lines, the chief products being acetone and carbon dioxide.

It is evident that the permanganate reacts with all this series of acids in a parallel manner, and can therefore be used to estimate any one of them only in the proved absence of the others.

162. "The direct union of carbon and hydrogen. Synthesis of methane." Part II. By William Arthur Bone and Hubert Frank Coward.

In continuation of their previous experiments (*Trans.*, 1908, **93**, 1975), the authors are now able to report a not less than 95 per cent. yield of methane from less than 0·03 gram of highly purified sugar charcoal (containing not more than 0·06 per cent. of ash and less than 0·1 per cent. of hydrogen) by maintaining it in a steady current of pure dry hydrogen at 1150° for from seventeen to twenty-five hours continuously, thus completing the proof of the direct synthesis of methane from its elements at this temperature.

163. "The existence of racemic compounds in solution." By Albert Ernest Dunstan and Ferdinand Bernard Thole.

In continuation of their previous work (*Trans.*, 1908, **93**, 1815) the authors have investigated the viscosity-concentration relationships for various solutions of active and racemic compounds. The *sec.*-octyl hydrogen phthalates (*d*-, *l*-, and inactive forms) were examined in benzene solution, and were found to give identical curves. Hence the inactive ester does not exist in solution as a racemic compound.

The *d*-, *l*-, and *r*-mandelic acids have the same viscosity in aqueous and in pyridine solutions, but when the viscosities were determined in a non-dissociating solvent, such as amyl acetate, a clear difference between the active and inactive forms was apparent.

Adriani (*Zeitsch. physikal. Chem.*, 1900, **33**, 413) has already proved by Roozeboom's method that *r*-mandelic acid exists in the fused state.

In further support of the previous work on the tartaric acids, it was shown that a solution of racemic acid mixed with *d*-tartaric acid has a viscosity different from that of a solution of the pure *d*-acid of identical concentration.

164. "Note on the occurrence of osyritrin (violaquercitrin) in Osyris abyssinica." By Samuel James Manson Auld.

In an examination of "Pruimbast" or "Cape Sumach," *Osyris compressa* (*Colpoon compressum*), A. G. Perkin (*Trans.*, 1897, **71**, 1132) separated a glucoside, *osyritrin*, which he later showed to be identical with violaquercitrin, isolated previously by Mandelin (*Jahresber*, 1883, 1369) from *Viola tricolor*. Samples of Cape sumach have been examined at the Imperial Institute from time to time, and no difficulty has been experienced in separating the osyritrin from them.

Recently a considerable consignment of the leaves and stalks of *Osyris abyssinica*, Höchst, has been received for examination from the Transvaal. The material as received gave a much deeper coloured extract than Cape sumach, and produced a darker leather of rather poor quality. The aqueous extract, on keeping, deposited a certain amount of solid matter, but this did not appear at all similar to the crystalline deposits previously obtained from *Osyris compressa.* The new material was therefore examined more closely.

The Tannins.—Analysis showed that the leaves contained about 23 per cent. of tannin.

The leaves were extracted with water and the extract evaporated to a small bulk, when there separated a quantity of solid matter consisting of colouring principle and the phlobaphen of the tannin. The aqueous solution was fractionally precipitated with lead acetate, and the last fraction washed and decomposed with hydrogen sulphide. After removal of the lead sulphide and the excess of hydrogen sulphide, the solution was evaporated to dryness. It yielded a reddish-brown tannin of the catechol series. This tannin is much darker than that previously obtained from *Osyris compressa*, and it also shows more readiness to lose water and form the phlobaphen.

Extraction of the Colouring Matter.—The coarsely-ground leaves were thoroughly extracted in a Soxhlet apparatus with 90 per cent. alcohol, and the residue, after removing the spirit, was poured into water. The green mass which separated was filtered off, and, after drying, was extracted separately with light petroleum and alcohol. The alcoholic extract set to a viscid, semi-solid mass on concentration. By pouring into excess of boiling water it was possible to separate a large quantity of dark brown insoluble matter of a phlobaphen nature, and on cooling the aqueous solution, a dirty brown solid deposit was obtained, which, after repeated precipitation with water from alcoholic solution, yielded a mass of small crystals. These were purified by several crystallisations from dilute alcohol and finally from boiling water.

A further quantity of the same substance was obtained by deposition from the main filtrate containing the tannin.

The substance formed small, greenish-yellow needles, melting at 189—190°, after softening at 185—186° (osyritrin melts at 186°). After being dried at 160°, it gave on analysis:

$C = 53{\cdot}17$; $H = 4{\cdot}51$. $C_{27}H_{28}O_{16}$ requires $C = 53{\cdot}28$; $H = 4{\cdot}60$ per cent.

After being dried at 160°: Found, $H_2O = 7{\cdot}90$. $C_{27}H_{28}O_{16},3H_2O$ requires $H_2O = 8{\cdot}15$ per cent.

On hydrolysis with dilute acid the substance gives an insoluble colouring matter and a sugar.

The latter is dextrorotatory, and gives an osazone melting at 204—205°. Estimation of the colouring matter gave $C_{15}H_{10}O_7 =$ 45·45. The equation $C_{27}H_{28}O_{16} + 3H_2O = C_{15}H_{10}O_7 + 2C_6H_{12}O_6$ requires $C_{15}H_{10}O_7 = 45·61$ per cent.

The colouring matter has all the properties of quercetin, and the penta-acetyl compound, prepared in the usual manner, melted at 190° and gave on analysis :

$C = 58·48$; $H = 3·93$. Calc. $C = 58·59$; $H = 3·90$ per cent.

The glucoside is therefore identical with osyritrin.

165. "The relative influence of the ketonic and ethenoid linkings on refractive power." By Ida Smedley.

The molecular refractions of the following unsaturated ketones were determined in chloroform solution :

	M_α.	M_β.	M_γ.
Benzylideneacetone	48·52	51·33	53·79
Benzylideneacetophenone	70·48	75·30	80·2
Cinnamylideneacetone	64·19	70·76	—
Dibenzylideneacetone	84·04	92·17	—
Cinnamylideneacetophenone	87·59	98·17	—
Cinnamylidenebenzylideneacetone ...	102·69	—	—
Dicinnamylideneacetone	121·5	—	—

The conclusion is drawn that, placed at one end of a chain of conjugated ethenoid linkings, the ketonic and ethenoid linkings have apparently the same effect in exalting refractive power. When interposed in a chain of ethenoid linkings, the effect of the carbonyl group diminishes the exaltation. Its effect is probably then comparable with that of an ethenoid linking contained in a side-chain.

166. "The constitution of the β-diketones." By Ida Smedley.

The evidence from the physical properties of the β-diketones was shown to be in harmony with a hydroxy-ketonic structure, and it is found unnecessary to assume the existence of the di-enolic form. Dibenzoyldimethylmethane (m. p. 99°) was prepared, and the molecular refractions of the following substances were determined in chloroform solutions.

	M_α.	$M_\beta - M_\alpha$.
Benzoylacetone	50·3	3·2
Dibenzoylmethane	74·6	6·9
Dibenzoylethylmethane	75·0	3·4
Dibenzoyldimethylmethane	76·0	2·3
Ethoxybenzylideneacetophenone ..	79·6	5·2
Tetraphenylallene	117·7	6·7
Tetraphenylacetone	115·3	4·0

In the preparation of tetraphenylallene (Vorländer, *Ber.*, 1906, **39**, 1024), tetraphenylacetone, m. p. 28°, was isolated.

The action of the Grignard reagent on dibenzoylmethane and benzoyldimethylmethane was also studied.

167. "An apparatus for the distillation of fats and fatty acids in the vacuum of the cathode light." By [the late] James Campbell Brown.

In the course of an investigation of the constitution of various naturally-occurring fats, it became desirable to subject the fats themselves, and also the acids derived from them, to fractional distillation in a high vacuum, with a view to effecting, if possible, a separation into their constituents.

Distillations in the vacuum of the cathode light have been previously carried out, notably by Krafft (*Ber.*, 1896, **29**, 1316), but it was thought that the apparatus used might be considerably improved, more particularly in the case of the receiver.

A series of experiments was therefore entered upon with this object in view, and the apparatus described below is the outcome. It consists essentially of a desiccator, made with a broad flange, on to which the lid was very carefully ground by means of carborundum powder. Inside the lower portion of the desiccator a circular iron plate was fitted on glass bearings in such a way that it could revolve very freely. The best method of doing this was found to be as follows.

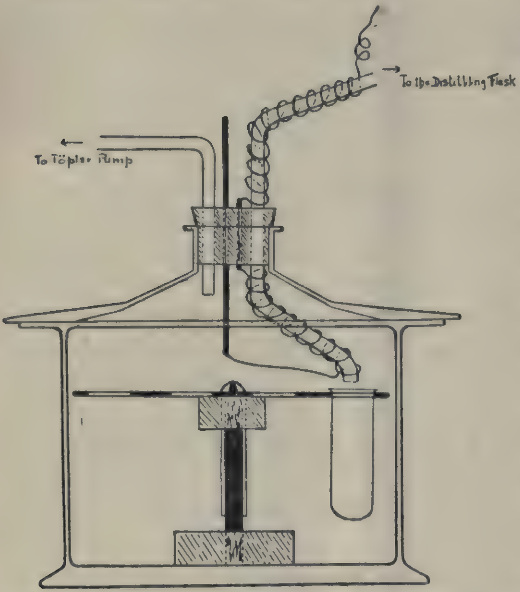
A cork, or, as was afterwards used, a block of lead carrying a pointed glass rod, was cemented to the bottom of the vessel in an exactly central position. The plate was fitted by means of a cork cemented firmly to it with a glass tube which would pass freely over the rod, and the sealed end of which rested on the point of the latter.

The plate was pierced near its rim with eight holes, each of which carried a test-tube, and each of these tubes could be brought in turn beneath the delivery-tube by means of a magnet worked on the outside of the vessel.

The lid of the desiccator was fitted with a tightly fitting rubber cork, through which passed the delivery-tube and the exit-tube, and also two thick brass rods, the use of which will be explained later. In the earlier experiments this cork was fitted with a mercury tube, but it was found that this was unnecessary, and that the same end could be obtained by lubricating the stopper with a small amount of glycerol. The delivery-tube was sealed to the flask which contained the substance to be distilled, whilst the exit-tube was sealed to a Töpler pump. On the exit-tube was sealed a vacuum tube, through which the passage of an electric discharge was used to determine the vacuum.

On testing the apparatus it was found to hold a vacuum, in which the green fluorescence was visible for at least two hours, and as it was intended to keep the pump at work throughout each experiment, this was considered quite satisfactory.

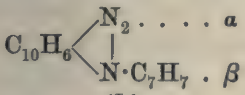
In the distillation of acids the melting point of which was in the neighbourhood of 70°, a difficulty was met with. The acid solidified in the delivery-tube inside the desiccator, and thus brought the distillation to an abrupt close. This difficulty was surmounted by wrapping the delivery-tube with resistance wire both inside and outside the receiver, and keeping the tube hot by passing a current through the wire. In order to prevent the acid from solidifying in the portion of the tube which passed through the stopper, the tube was heated for about twenty minutes before the experiment was started, and the difficulty was in this way overcome. The brass rods previously mentioned were used to convey the current through the stopper.



The working of the apparatus will be better understood by reference to the figure, which shows an elevation of the receiver, and a plan of the revolving plate. Many experiments were carried out with it, and in all these it worked extremely well. Its advantages are that it occupies an extremely small space, and that a distillate can readily be divided into any number of fractions, it is very easy to manipulate, while at the same time very high vacua indeed can be maintained in it over a comparatively extended period.

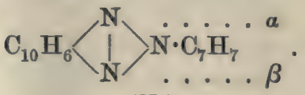
168. "The *p*-tolyl-1 : 2-naphthylenediazoimines (3-*p*-tolyl-β-naphtha*iso*triazoles)." (Preliminary note.) By G. T. Morgan and Arthur Bramley.

The authors have prepared 2-p-*tolylnaphthylene*-1-*diazo*-2-*imine* (3-p-*tolyl*-β-*naphtha*iso*triazole*) (I), m. p. 165—166°, by the action of nitrous acid on 2-*p*-tolyl-1 : 2-naphthylenediamine, and its isomeride, 2-*p*-tolyl-1 : 2-naphthatriazole (II), m. p. 149° ; the latter substance was obtained by oxidising *p*-tolueneazo-β-naphthylamine (m. p. 113°) with chromic acid, and corresponds in properties with the product recently isolated by G. Charrier on heating the foregoing azo-β naphthylamine at 300° (*Atti R. Accad. Sci. Torino*, 1910, **45**, 131).



$$C_{10}H_6\left\langle\begin{array}{l} N_2 \ .\ .\ .\ .\ a \\ \ | \\ N\cdot C_7H_7\ .\ \beta \end{array}\right.$$

(I.)



$$C_{10}H_6\left\langle\begin{array}{c} N \\ | \\ N \end{array}\right\rangle N\cdot C_7H_7 \quad \begin{array}{l} .\ .\ .\ .\ .\ a \\ \\ .\ .\ .\ .\ .\ \beta \end{array}.$$

(II.)

The authors propose to examine the physical and chemical properties of other members of the two series of triazenes indicated by the above formulæ.

169. "A note on the aromatic derivatives of antimony." By G. T. Morgan, F. M. G. Micklethwait, and G. S. Whitby.

In pursuing the investigation of certain derivatives of triphenylstibine oxide recently described (*Trans.*, 1910, **97**, 34), the authors have found that the nitration of triphenylstibine leads to the formation of a *nitro*-derivative, melting at 190°, from which, by reduction, a diazotisable *amine* can be obtained. Some of the acyl derivatives of this base have been prepared.

By the nitration of triphenylstibine hydroxynitrate, a *trinitro*-compound is produced, which on reduction yields a crystallisable *triamine*, furnishing a crystalline *hydrochloride*. This base has also given *acetyl* and *azo-β-naphthol* derivatives, together with *platini*- and *stanni-chlorides*.

The sulphonation of triphenylstibine and triphenylstibine hydroxysulphate has been undertaken, and a soluble *trisulphonic acid* obtained, yielding very soluble alkali salts.

The authors are at present engaged in the further study of these and other derivatives of triphenylstibine.

LIST OF FELLOWS, 1910.

The List of Fellows for 1910 is now in active preparation, and changes of address received after 30th June cannot be included in it.

In order that the new list may be as complete as possible, those Fellows whose degrees and Christian names do not appear in full are requested to communicate them to the Assistant Secretary.

At the next Ordinary Scientific Meeting on **Thursday,** June **16th,** 1910, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Studies of dynamic isomerism. Part XII. The equations for two consecutive unimolecular changes." By T. M. Lowry and W. T. John.

"Studies of dynamic isomerism. Part XIII. Camphorcarboxyamide and camphorcarboxypiperidide." By W. H. Glover and T. M. Lowry.

"The constitution of orthodiazoimines. Part I. The naphthylenediazoimines and their benzenesulphonyl derivatives." By G. T. Morgan and W. Godden.

"The colour and constitution of diazonium salts. Part II. Diazo-derivatives of *as*-benzylethyl-1 : 4-naphthylenediamine." By G. T. Morgan and E. G. Couzens.

"The action of alkalis on certain derivatives of coumarin." By A. Clayton.

"The colour and constitution of the amino-coumarins." By A. Clayton.

"The relation between absorption spectra and chemical constitution. Part XV. The nitrated azo-compounds." By E. C. C. Baly, W. B. Tuck, and Miss E. G. Marsden.

"Indirubin. Part I." By W. P. Bloxam and A. G. Perkin.

"Estimation of sodium and cæsium as bismuth nitrites. Part I. Estimation of sodium." By W. C. Ball.

"The by-products of alcoholic fermentation." By Miss C. E. Ashdown and J. T. Hewitt.

"A simple method of preparing tetranitromethane." By F. D. Chattaway.

"Dimethoxy-*p*-tolylphenylmethane." By J. E. Mackenzie.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics.*

The following Candidates have been proposed for election. A ballot will be held on Thursday, June 16th, 1910.

Batley, Ward Allen,

197, Eccles New Road, Salford, Manchester.

Science Lecturer. B.Sc. (Chemistry and Physics) Manchester University, 1908. M.Sc. (Chemistry) 1909. Wishful to keep abreast with chemical research.

Harold B. Dixon.	Alfred Holt, jun.
W. H. Perkin.	Ch. Weizmann.
Norman Smith.	*Arthur Lapworth.*

Bracewell, Geoffrey Alfred,

20, Heaton Grove, Bradford.

Analytical and Consulting Chemist. For one year at Leeds University (Science Dept.). For three years with F. W. Richardson, Esq., F.I.C. Joint Author with F. W. Richardson, Esq.: "Factors in the Analysis of Beeswax, Woolgrease," etc., Soc. Chem. Industry. Fellow of the Royal Microscopical Society.

F. W. Richardson.	F. W. Branson.
A. Jaffé.	B. A. Burrell.

George H. Martin.

Collett, Ronald Leslie,

Little Dawley, Hayes, Middlesex.

Analytical Chemist. B.A. (Cantab.) Natural Science Tripos. Associate of the Institute of Chemistry.

Bernard Dyer.	Herbert Jackson.
John M. Thomson.	Patrick H. Kirkaldy.

Alf. Chaston Chapman.

Dand, Middleton Henry,

Steyning, Sussex.

Brewer. Have spent many years in the study and practice of Chemistry as applied to the brewing industry, and am the inventor of the "Dand Forcing Tray Flask" and the "Lawrence-Dand Refrigerators."

Basil Wm. Valentin.
Francis Davidson.
A. J. Murphy.
F. G. Adair Roberts.
B. E. R. Newlands.
John Joseph Eastick.

Dodd, Alexander Scott,

173, Bruntsfield Place, Edinburgh.

Analytical Chemist. (1) Six and a half years' experience in Analytical Chemistry under J. Falconer King, Esq., F.I.C., City Analyst of Edinburgh. (2) Associate of the Institute of Chemistry. (3) B.Sc. Final in Chemistry on the Higher Standard at Edinburgh University.

J. Falconer King.
John E. Mackenzie.
James Walker.
Leonard Dobbin.
J. P. Longstaff.
Alex. C. Cumming.

Grieve, James,

127, Buchanan Street, Glasgow.

Chemist. Pharmaceutical Chemist; Member of the Pharmaceutical Society; Lecturer on Pharmacy and Materia Medica at the Glasgow and West of Scotland Technical College; a Director of Frazer and Green, Ltd., Manufacturing Chemists, Glasgow.

Martin Dechan.
W. H. Martindale.
Alex. Gunn.
W. L. Howie.
C. R. Hennings.
Arthur W. Crossley.
Chas. Horne Warner.
Charles Alex. Hill.
Charles Gilling.
Thomas Cockburn.

Guhlmann, Charles Frederick,

Grantwood, Bergen Co., New Jersey, U.S.A.

Chief Chemist, General Chemical Company of New York, "Hudson River Works," U.S.A. University of Pennsylvania, Mining Engineering and Chemistry Class, 1896. From 1896 to 1906, Chief Chemist, Harrison Bros. & Co., Chemical Wks., Philadelphia. From 1906 up to and including present time, Chief Chemist, Gen. Chem. Co., Hudson River Works. Inorganic and Organic Research in Manufacturing and Analytical Chemistry.

T. Lynton Briggs. Hardee Chambliss.
G. T. Bruckmann. *Charles F. Chandler.*
Marston T. Bogert.

Hackford, John Edward,

15, Burford Road, Nottingham.

Chemist to the Russian Steam Oilmill Co., St. Petersburg. B.Sc. 2nd Class Honours (Lond.). A.I.C. Joint author of: (1) "The Electrolytical Estimation of Minute Quantities of Arsenic," Sand & Hackford, (*J.C.S.*, 1904, p. 1018), and (2) "The Preparation of Silicols from Silicones, and their Spontaneous Transformation into Oxides," Kipping & Hackford (to be published shortly).

R. M. Caven. F. Stanley Kipping.
Henry J. S. Sand. Arthur Slator.
G. Druce Lander.

Haycock, John,

Great Glen, near Leicester.

Analytical Chemist. Pharmaceutical Chemist. Chief Chemist to Messrs. T. H. Lloyd & Co., Leicester At present engaged on elaborating a new method for the separation and estimation of Cinchona alkaloids. Wishes to keep in contact with current chemical knowledge.

Edward Masters. S. F. Burford.
C. T. Bennett. *Ernest J. Parry.*
H. D. Law.

Huck, John,

The Foundation, St. Bees School, Cumberland.

Schoolmaster. Senior Science Master St. Bees School. M.A. Cantab. 1st Class Natural Science Tripos, Pt. I., 1904. Scholar and Prizeman, Selwyn College, Cambridge. Science Master and Lecturer: Berkhamsted School, Herts (2 years); St. Bees School, Cumberland (4 years).

George Dixon. C. T. Heycock.
John Parkin. R. H. Adie.
L. A. Borradaile. C. H. H. Walker.
Robert Hellon.

Jacobs, Lionel Leslie,

Shelford, Beckenham, Kent.

Assistant Manager. Dominion Tar and Chemical Co.'s Works, Sault Ste. Marie, Ont. Student of Chemistry studying for degree.

Some knowledge and technical experience of Coal Tar Products. Shortly to assist in research work in Coal Tar Products.

George Barger. Geo. Jas. Woods.
Reginald W. L. Clarke. Elkan Wechsler.
Isaac S. Scarf.

Joshi, Govind Laxman,
5, Argyle Avenue, Victoria Park, Manchester.

Govt. of India State Technical Scholar. L. T. M. (Bombay), the course of study being Textile Chemistry, Physics, Mathematics and Engineering. Studied Applied Chemistry at the Muncipal School of Technology and I am desirous of keeping in touch with the latest researches in Chemistry.

Jas. Grant. F. S. Sinnatt.
F. G. Richards. S. J. Peachey.
E. L. Rhead.

Long, Frank Stevenson,
"Hadley," 80, Tylney Road, Forest Gate.

Demonstrator, Chemical Dept., East London College. B.Sc. (Lond.). At present engaged in research.

J. T. Hewitt. S. H. Woolhouse.
F. G. Pope. Clarence Smith.
J. J. Fox.

Martin, William Ernest,
111, Bellevue Rd., Berea, Durban, Natal.

Explosives Chemist. Chief Chemist, Kynoch Ltd., Umboputurin, Durban. Seven years Assistant, Government Laboratory, Waltham Abbey, Essex. Four years Chemist in charge of Guncotton Factory, Kynoch, Ltd. Seven years Chief Chemist, Kynoch, Ltd., Arklow.

Walter H. Pay. J. S. Jamieson.
H. H. C. Puntan. *E. Nevill.*
A. B. Tonkin.

Narbeth, Benjamin Mason,
Durban Technical Institute.

Principal of the Durban Technical Institute. Bachelor of Science in the University of Wales. Formerly Lecturer at the Swindon and North Wilts Technical Institute. Studied Chemistry at St. John's College, Battersea, and at University College, Cardiff.

J. S. Jamieson. A. B. Tonkin.
E. Nevill. *H. H. C. Puntan.*
Walter H. Pay.

Oakley, Robert O'Field,

54, Sydney Rd., Hornsey, N.

Student of Gray's Inn; Civil Servant. London Matriculation, 1903, 1st class; Int. B.Sc., 1904, 1st class; National Scholarship in Chemistry, 1905; parts I. and II. in Chemistry at the Royal College of Science, 1905–7, 1st class; took B.Sc. Honours course with Dr. W. H. Mills at the Northern Polytechnic, 1908–9.

M. O. Forster.	James C. Philip.
G. T. Morgan.	E. G. Couzens.
William A. Tilden.	A. Clayton.

Paris, Edward Talbot,

15, Montpellier Villas, Cheltenham.

Lecturer in Chemistry, Cheltenham Technical Schools. Lecturer to Science and Technical Students and Teachers; holds advance certificates in Chemistry; Hon. Assist. Sec. to the Cotteswold Nat. F. C.; Author of several palæontological communications; engaged in Chemico-geological research work.

J. M. Collett.	Gerald T. Moody.
G. W. Headley.	*Frank Dixon.*

Alfred C. Youngs.

Reddie, John Alexander,

3, Spring Gardens, Bradford, Yorks.

Chemical-Bacteriological Assistant to the Sewage Committee of the Bradford Corporation for the last 7 years. Constantly engaged in research work at the Bradford Sewage Works, and have recently isolated the Anthrax bacillus, and other specific organisms, from the Sewage of Bradford.

F. W. Richardson.	Walter M. Gardner.
A. Jaffé.	Barker North.

George H. Martin.

Reed, Walter William, M.Sc. (Wales), A.I.C.,

28, South Parade, Huddersfield.

Assistant Lecturer in Chemistry, Technical College, Huddersfield. First Class Hons. in Chemistry B.Sc. (Wales), June, 1906. Isaac Roberts Research Scholar, University College of North Wales, Bangor, 1906–8. M.Sc. (Wales), June, 1908. Associate of the Institute of Chemistry, April, 1908. Joint Author with Prof. K. J. P. Orton, of "The Wandering of Bromine in the Chlorination of Bromoanilines" (*Trans.*, 1907, **91**, 1543), and "Isomeric Change in Benzene Derivatives. Replacement of Halogen by Hydroxyl in Chlorobromodiazobenzenes" (*Trans.*, 1907, **91**, 1554).

Kennedy J. P. Orton.
James J. Dobbie.
Alexander Lauder.
James Bruce.
Allan Baguley.

Rose, John George,

Government Analytical Laboratory, Cape Town, Cape Colony.

Government Analyst. Has occupied his present position of Analyst in the Government Analytical Laboratory, Department of Agriculture, Cape Colony, for the last thirteen years, i.e., since March 14th, 1897; vide "Official Chemical Appointments," 3rd edition.

J. Muller.
E. V. Flack.
George N. Blackshaw.
Walter D. Severn.
Arthur Stead.

Sinclair, St. Clair Overbeck, M.A.,

Government Analytical Laboratory, Grahamstown, Cape Colony.

Government Analyst. Has occupied his present position of Analyst in the Government Analytical Laboratory, Department of Agriculture, Cape Colony, for the last thirteen years, i.e., since August 5th, 1897; vide "Official Chemical Appointments," 3rd edition.

J. Muller.
E. V. Flack.
George N. Blackshaw.
Walter D. Severn.
Arthur Stead.

Slade, Roland Edgar,

Muspratt Laboratory, The University, Liverpool.

Assistant Lecturer and Demonstrator in Physical Chemistry. B.Sc. Honours in Chemistry (Victoria), 1906. Mercer Scholar. M.Sc. (Victoria), 1907. 1907–8, Assistant Chemist to British Aluminium Co., Ltd. 1908, Gartside Scholar. 1909, Assistant Lecturer in Physical Chemistry at Liverpool University. Publications: "The Reducibility of Magnesium Oxide by Carbon" (*Trans.*, 1908, **94**, 327).

F. G. Donnan.
V. J. Harding.
Ch. Weizmann.
R. Robinson.
W. H. Perkin.

Smith, James Harry,

5, Turks Road, Radcliffe, Lancs.

Chemist. Conduct Analyses. Member of the Pharmaceutical Society. Desirous of keeping in touch with recent developments of Chemistry.

J. Rymer Young.
George Clayton.
F. Smith.
James S. Broome.
Wm. Scholes.
James Ashton.

Smith, Thomas May,

"Walla Crag," Osborne Road, Romford.

Trade Manager, A. Boake Roberts & Co., Ltd., Stratford, E. Has been engaged in Practical Brewing for upwards of twenty years; has had a large number of pupils through his hands; has contributed largely to the brewing literature and obtained first prize for the best Article on "Practical Brewing," in the Technical Journal, Feb., 1905.

Basil P. Wigan.
Alex. K. Miller.
A. Boake.

A. Leonard H. Garside.
Basil Wm. Valentin.
J. Ross Mackenzie.

Stedman, Ernest,

6, Breakwater Road, Bude, Cornwall.

Science Master. Victoria University, B.Sc. with Second Class Honours in Chemistry, 1908. Teacher of Science in Bude County School. Am desirous of keeping in touch with chemical publications.

Harold B. Dixon.
W. H. Perkin.
Norman Smith.

Ch. Weizmann.
Robert Robinson.
V. J. Harding.

Thole, Ferdinand Bernard,

23, Cowper Avenue, East Ham, Essex.

Assistant Lecturer, East Ham Technical College. B.Sc. (Lond.), 1st Class Honours Chemistry. Published research with Prof. Hewitt on "Colour and Constitution of Azo-Compounds," and with Mr. Dunstan on "The Relation between Viscosity and Chemical Constitution."

W. H. Barker.
F. G. Pope.

J. T. Hewitt.
Albert E. Dunstan.

W. T. Clough.

Williams, Frederick George,

5, Mayhill Road, Charlton, S.E.

Metallurgist. For seven years First Assistant to the Metallurgist, Royal Gun Factories, Royal Arsenal, Woolwich. Training in Chemistry and Metallurgy at the Birkbeck College, Chancery Lane, London.

Wesley Lambert.
A. H. Mundey.

R. J. Redding.
H. Russell Pitt.

H. Heron Smith.

The following Certificates have been authorised for presentation to Ballot by the Council, under Bye-law I (3):

Sorabji, Kaikhushroo Bamanji,
Secunderabad, Deccan, India.

Graduate in Medicine and Surgery of the Bombay University. Engaged in Chemical Analysis. The object is to be always well-informed of the latest researches in Chemical Science.

E. M. Modi.

Williams, John,
122, Liddell Street, Invercargill, New Zealand.

Trained Teacher. Chemistry Master, Southland Boys' High School, Invercargill, and Technical School, Invercargill, since Sept. 1907. (1) Bachelor of Science, London, in Chemistry, Physics and Mathematics. Bachelor of Science, New Zealand. (2) Triple Honours in Chemistry, Board of Education. (3) Teacher of Theoretical and Practical Chemistry in the Technical School, Brierley Hill.

Wm. Whitehouse. Frank E. Thompson.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C. AND BUNGAY, SUFFOLK.

Issued 29/6/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 374.

Thursday, June 16th, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. A. Clayton, Frederick C. Lewis, and Charles Proud were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Henry Vincent Aird Briscoe, B.Sc., 33, Bargery Road, Catford, S.E.
David Jackson MacGeorge, Rangoon Refinery Co., Ltd., Thilawa, Burma.
Alec Duncan Mitchell, B.Sc., Carnock, Hartley Road, Leytonstone, N.E.
William James Pittock Smith, 9, Meddowcroft Road, Gerard Road, Wallasey.
Claude Vareille Temperley, B.Sc., Trent College.
Richard Babington Turbutt, B.A., Royal Artillery Mess, Woolwich.
Herbert Goulding Williams, B.Sc., Robert Gordon's College, Aberdeen.
William Norman Stewart Wright, 26, Lansdowne Crescent, Glasgow, W.

A Certificate has been authorised by the Council for presentation to Ballot under Bye-law I (3) in favour of:

Professor Leo Tschugaeff, The University, St. Petersburg.

A ballot for the election of Fellows was held, and the following were subsequently declared duly elected :

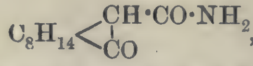
Ward Allen Batley, M.Sc.
Geoffrey Alfred Bracewell.
Ronald Leslie Collett, B.A.
Middleton Henry Daud.
Alexander Scott Dodd, B.Sc.
James Grieve.
Charles Frederick Guhlmann.
John Edward Hackford, B.Sc.
John Haycock.
John Huck, M.A.
Lionel Leslie Jacobs.
Govind Laxman Joshi.
Frank Stevenson Long, B.Sc.
William Ernest Martin.
Benjamin Mason Narbeth, B.Sc.
Robert O'Field Oakley.
Edward Talbot Paris.
John Alexander Reddie.
Walter William Reed, M.Sc.
John George Rose.
St. Clair Overbeck Sinclair, M.A.
Roland Edgar Slade, M.Sc.
James Harry Smith.
Thomas May Smith.
Kaikhushroo Bamanji Sorabji.
Ernest Stedman, B.Sc.
Ferdinand Bernard Thole, B.Sc.
Frederick George Williams.
John Williams, B.Sc.

Of the following papers, those marked * were read :

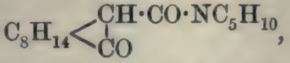
*170. "Studies of dynamic isomerism. Part XII. The equations for two consecutive unimolecular changes." By Thomas Martin Lowry and William Thomas John.

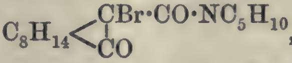
The problem considered is that of a reversible isomeric change of the type $A \rightleftarrows B \rightleftarrows C$, in which the intermediate compound, B, is formed in quantities comparable with those of the initial material, A, and the final product, C. Equations are deduced for the changes of concentration with time in the case of each of the three substances : (*a*) when the sum of the concentrations is constant, as in an ordinary "mutarotation" experiment, and (*b*) when the concentration of the initial material is kept constant, for example, by saturation with the solid. The curve connecting concentration with time in the case of the compound C is inflected in character, the position of the point of inflexion depending on the four velocity constants corresponding with the four arrows of the above equation. Curves, showing the point of inflexion and the tangent at this point, have been drawn for a number of typical cases.

*171. "Studies of dynamic isomerism. Part XIII. Camphorcarboxyamide and camphorcarboxypiperidide." By Walter Hamis Glover and Thomas Martin Lowry.

Camphorcarboxyamide,  $C_8H_{14}<\begin{matrix}CH\cdot CO\cdot NH_2\\ | \\ CO\end{matrix}$, prepared by heating the methyl ester with aqueous ammonia in a sealed tube at 100°, crystallises well from benzene, heptane, or light petroleum, melts at 118°, and gives an indigo coloration with ferric chloride. Changes of rotatory power are observed in freshly-prepared solutions of the amide in heptane, benzene, and alcohol. The solubility in heptane at 20° shows an analogous change, from 0·38 to 0·80 per cent., in the course of the first hour or two after the solvent is added, indicating that the initial material forms about 48 per cent. of the final product.

The *bromoamide*, $C_8H_{14}<\begin{matrix}CBr\cdot CO\cdot NH_2\\ |\\ CO\end{matrix}$, melts at 114°, and gives no coloration with ferric chloride.

The *piperidide*,  $C_8H_{14}<\begin{matrix}CH\cdot CO\cdot NC_5H_{10}\\ |\\ CO\end{matrix}$, prepared by the action of piperidine on the ester, melts at 106°, and gives a greenish coloration with ferric chloride. Changes of rotatory power are observed in freshly-prepared solutions in heptane, benzene, and alcohol, but the mutarotation curves do not obey the unimolecular law, and the curves for solutions in benzene are strongly inflected; the abnormal character of the curves is attributed to the occurrence of two consecutive isomeric changes. The solubility in heptane increases from 2·06 to 4·66 per cent., and the proportion of the initial material in the final product is taken to be about 44 per cent.

The *bromo-piperidide*,  $C_8H_{14}<\begin{matrix}CBr\cdot CO\cdot NC_5H_{10}\\ |\\ CO\end{matrix}$, melts at 132°, gives no coloration with ferric chloride, and undergoes no changes of rotatory power in freshly-prepared solutions.

DISCUSSION.

Mr. BALY asked what evidence Dr. Lowry had that the compounds described exist in the enolic form. It appeared to him that the results described by Dr. Lowry in his last two papers (*Trans.*, 1910, **97**, 899 and 905) were capable of another explanation, and that the existence of the enolic form was not proved by the spectroscopic observations. Of course these remarks did not influence in any way the value of the curves under discussion, but Mr. Baly questioned the advisability of assuming the existence of the enolic modifications if this assumption were only based upon the spectroscopic observations described in the previous work.

Dr. SENTER asked, in reference to the observations on initial retardation, with what vessels the optically active substances had been in contact during the experiments.

In reply to Mr. Baly, Dr. LOWRY said that in order to account for the inflected mutarotation curves it was only necessary to assume two successive isomeric changes in compounds of approximately equal stability. The intermediate compound was probably enolic, but this was not essential. In reply to Dr. Senter, both glass and silica tubes had been used; the velocities of isomeric change varied considerably, but the general form of the curves was the same for high and for low velocities.

*172. "A simple method of preparing tetranitromethane."

By Frederick Daniel Chattaway.

Tetranitromethane in nearly theoretical amount can be obtained, if a suitable procedure be adopted, by the interaction of nitric acid and acetic anhydride.

The action of nitric acid on acetic anhydride has been described as dangerously violent. This, however, is not the case unless the temperature at which they are brought together is unnecessarily high.

When nitric acid attacks acetic anhydride a mononitro-derivative is probably first produced, which is so much more readily nitrated than the parent compound that action proceeds until the three hydrogen atoms of a methyl group have been replaced. The trinitroacetic acid formed by hydrolysis then slowly decomposes into carbon dioxide and nitroform, which is converted as soon as it is liberated into tetranitromethane.

The methods adopted in preparing, isolating, and purifying tetranitromethane were described.

The necessary operations are so simple and so easily carried out that the preparation is well adapted to take its place in any elementary course of practical organic chemistry to illustrate the ease with which aliphatic compounds can be nitrated, whilst the materials employed are so cheap and the yield is so satisfactory as to make tetranitromethane, which has hitherto been a somewhat unfamiliar substance, one of the most easily procurable of organic compounds.

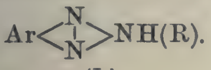
DISCUSSION.

The PRESIDENT asked whether Dr. Chattaway had any proof of the formation of nitroform.

Dr. CHATTAWAY said that he had no proof that nitroform was actually liberated as an intermediate product, but its formation appeared to be a necessary step in the series of reactions which must be assumed to take place. The conditions of interaction were such that it would be difficult, if not impossible, to recognise it as an intermediate product, since, in small amount, it was formed by the action of water on tetranitromethane.

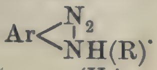
*173. "The constitution of ortho-diazoimines. Part I. The naphthylenediazoimines and their benzenesulphonyl derivatives." By Gilbert T. Morgan and William Godden.

The authors' experiments had for their object the determination of the constitution of the ortho-diazoimines produced by the action of nitrous acid on the ortho-diamines. If the ortho-diazoimines and their acyl derivatives are to be represented by the general formula (I),



$$\mathrm{Ar}\!<\!\begin{matrix}\mathrm{N}\\|\\\mathrm{N}\end{matrix}\!>\!\mathrm{NH(R)}.$$

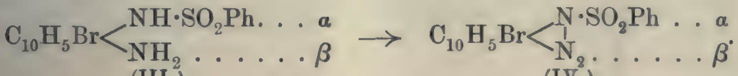
(I.)



$$\mathrm{Ar}\!<\!\begin{matrix}\mathrm{N_2}\\|\\\mathrm{NH(R)}\end{matrix}.$$

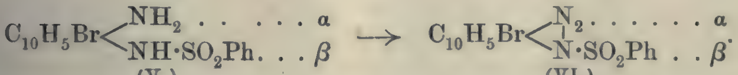
(II.)

then 1-*benzenesulphonyl*-4-*bromo*-1 : 2-*naphthylenediamine* (III) (m. p. 220°) and its isomeride, 2-*benzenesulphonyl*-4-*bromo*-1 : 2-*naphthylenediamine* (V) (m. p. 171°), should yield the same diazoimide; but on treatment with nitrous acid they give rise respectively to the isomeric compounds, 1-*benzenesulphonyl*-4-*bromonaphthylene*-2-*diazo*-1-*imide* (IV) (m. p. 159°) and 2-*benzenesulphonyl*-4-*bromonaphthylene*-1-*diazo*-2-*imide* (VI) (m. p. 209°).



$$\mathrm{C_{10}H_5Br}\!<\!\begin{matrix}\mathrm{NH{\cdot}SO_2Ph}\ldots\alpha\\\mathrm{NH_2}\ldots\ldots\beta\end{matrix}\longrightarrow\mathrm{C_{10}H_5Br}\!<\!\begin{matrix}\mathrm{N{\cdot}SO_2Ph}\ldots\alpha\\|\\\mathrm{N_2}\ldots\ldots\beta\end{matrix}.$$

(III.) (IV.)



$$\mathrm{C_{10}H_5Br}\!<\!\begin{matrix}\mathrm{NH_2}\ldots\ldots\alpha\\\mathrm{NH{\cdot}SO_2Ph}\ldots\beta\end{matrix}\longrightarrow\mathrm{C_{10}H_5Br}\!<\!\begin{matrix}\mathrm{N_2}\ldots\ldots\alpha\\|\\\mathrm{N{\cdot}SO_2Ph}\ldots\beta\end{matrix}.$$

(V.) (VI.)

These results indicate that the ortho-diazoimines and their acyl derivatives are more correctly represented by the general formula (II).

Further confirmation was obtained by a study of the diazoimino-derivatives of 1 : 2- and 2 : 3-naphthylenediamines.

*174. "The colour and constitution of diazonium salts. Part II. Diazo-derivatives of *as*-benzoylethyl-1 : 4-naphthylenediamine." By Gilbert T. Morgan and Edward G. Couzens.

as-*Benzoylethyl*-1 : 4-*naphthylenediamine*,

$$\mathrm{NH_2{\cdot}C_{10}H_6{\cdot}N(C_2H_5){\cdot}CO{\cdot}C_6H_5},$$

contains an ethyl group in the place of the more labile hydrogen atom of benzoyl-1 : 4-naphthylenediamine, $\mathrm{NH_2{\cdot}C_{10}H_6{\cdot}\underset{*}{NH}{\cdot}CO{\cdot}C_6H_5}$, yet both these bases give rise to yellow diazonium salts of considerable stability.

It follows that the colour of these diazo-derivatives is not due to any departure from the normal diazonium type consequent on a migration of hydrogen.

In the benzene series, the corresponding diazonium salts of benzoyl-*p*-phenylenediamine and the *as*-benzoylalkyl-*p*-phenylenediamines, although exceptionally stable, are colourless (*Trans.*, 1909, **95**, 1319).

The appearance of colour among aromatic diazonium salts is due, not to changes in the diazo-residue, but to an increase in the complexity of the aromatic nucleus with which this group is associated.

DISCUSSION.

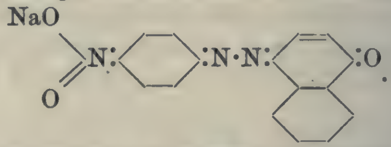
Dr. HEWITT stated that in view of the work just described, he fully accepted Dr. Morgan's conclusion that the *p*-acylaminodiazonium salts did not differ constitutionally from other diazonium salts.

*175. "The action of alkalis on certain derivatives of coumarin." By Arthur Clayton.

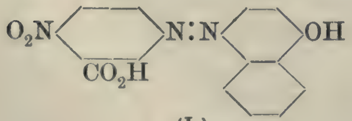
The action of alkalis on a number of nitro-derivatives of coumarin and its homologues has been investigated. Coumarins with a nitro-group in position 3 are converted by alkalis into the corresponding salicylaldehydes. If a methyl group is also present in position 4, a ω-nitro-α-methylstyrene is formed. Two new coumarinic acids have been isolated.

*176. "The relation between absorption spectra and chemical constitution. Part XV. The nitrated azo-compounds." By Edward Charles Cyril Baly, William Bradshaw Tuck, and Effie Gwendoline Marsden.

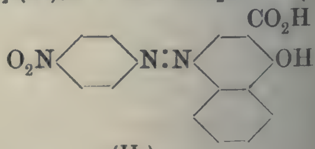
Hewitt and Mitchell (*Trans.*, 1907, **91**, 1251) dealt with the ortho- and para-nitrobenzeneazophenols and nitrobenzeneazo-α-naphthols, and from the change in colour produced on the addition of alkali hydroxides concluded that the sodium and potassium salts have the di-quinonoid structure, as, for example:



They also brought forward evidence to support this, based upon the two isomeric carboxy-derivatives (I) and (II), for the compound (I)



(I.)



(II.)

gives a blue lake with lead acetate, whilst (II) gives a red one.

It has now been shown from a comparison of the nitrobenzeneazophenols and their sodium salts with the corresponding nitrobenzeneazodimethylanilines, benzeneazophenol and its sodium salt, and with *p*-benzoquinoneazine, that the quinonoid explanation is incorrect. It is found that the carboxylic acids (I) and (II), as well as two other isomeric compounds which cannot possess two adjacent hydroxyl groups, give colloidal sodium salts. The solutions of these salts are precipitated by any metallic salt, as, for example, sodium chloride; the colour of these precipitates varies with the concentration, so that no conclusion whatever can be drawn as to two adjacent hydroxyl groups from the formation of insoluble precipitates with lead acetate.

DISCUSSION.

Dr. HEWITT dissented from Mr. Baly's view as to the constitution of the salts of *p*-nitrobenzeneazo-*α*-naphthol and allied compounds. Benzeneazo-*α*-naphthol gave an alcoholic solution which, if sufficiently dilute, was yellow, and the colour was altered to a comparatively slight extent by the addition of alkali. Substitution derivatives of the type: $p\text{-X}\cdot C_6H_4\cdot N\colon N\cdot C_{10}H_6\cdot OH$ behaved in a similar manner, where $X = Cl$, CO_2Na, SO_3Na, etc.; but where $X = NO_2$, $CH_3\cdot CO\cdot$ or $H\cdot CO\cdot$, then addition of alkali produced a far larger displacement of the band of least frequency, with the result that purple or blue solutions were obtained. The first class of substituents did not allow of a quinonoid structure for the alkali salts, but this was possible with substituents of the second class. Another remarkable example was afforded by *p*-nitrobenzeneazosalicylaldehyde, the yellow alcoholic solution of which was but slightly affected on rendering alkaline; this was probably owing to salt formation taking place with quinonoid rearrangement involving the aldehydo-group, so inhibiting the azobenzenequinone structure. Additional support was lent to this view by the fact that if the aldehydo-group was put out of action by conversion into a phenylhydrazone, addition of alkali produced an intense purple coloration.

Chemical properties were, however, far more important than optical in deciding questions of structure, and the observation made many years ago by Meldola, that *p*-nitro-substituted azophenols could be reduced smoothly to the corresponding amino-compounds by hydrogen sulphide in ammoniacal solution, showed that the ammonium salts of these *p*-nitro-compound possessed a different structure from the unsubstituted parent substances with the true azo-linking, since the latter underwent fission at the double linking between the nitrogen atoms.

In reply to Dr. Hewitt, Mr. BALY drew attention to an interesting fact about the blue alkaline solution of *p*-nitrobenzeneazo-*α*-naphthol.

In thin layers the solution was blue by transmitted light, but in thick layers it was pure red. This observation showed the danger of arguing entirely from visual colour. It appeared to him that Dr. Forster had drawn attention to the most important point, for the shifts observed on the addition of alkali to *o*-, *m*-, and *p*-nitrobenzeneazo-phenols and -*α*-naphthols were all very similar; indeed, *m*-nitrobenzeneazo-*α*-naphthol gave a greater shift than the *o*- and *p*-isomerides. Moreover, the shift given by benzeneazophenol was the same as that of the nitro-derivatives.

*177. "Indirubin. Part I."

By William Popplewell Bloxam and Arthur George Perkin.

In order to study the conditions necessary for the formation of indirubin by the air-oxidation of indoxyl, the authors have devised a method for the quantitative estimation of the former colouring matter in indigo. The dyestuff mixed with purified sand is introduced into a glass tube (25 × 90 mm. approx.) closed at one end with calico, which is placed in a Soxhlet apparatus and the material extracted with pyridine. The pyridine extract is evaporated finally with the addition of hot water, and the precipitate, which consists of indirubin and a little indigotin together with impurities, is collected on asbestos, washed with dilute hydrochloric acid to remove mineral matter, with 1 per cent. alkali to dissolve indigo-brown, and finally with 1 per cent. acetic acid solution. The crystalline residue is dried, sulphonated, and the solution of the mixed sulphonic acids analysed by means of the Duboscq colorimeter.

The residual mixture of sand and crude indigotin is washed in the Soxhlet apparatus with hot 10 per cent. sulphuric acid, which removes indigo gluten and some mineral matter, and with water until free from acid; the residue is then dried and sulphonated in the ordinary manner, the product dissolved in water, the solution filtered, and titrated with permanganate or titanium trichloride. The accuracy of the process has been determined by an examination of mixtures of pure indigotin and indirubin, and the reliability of the colorimetric work, in respect of the amount of colouring matter present, by means of titanium chloride. The authors have also analysed certain special varieties of Java indigo and other indigos, and it was further pointed out that by this pyridine method a quantitative determination of indigo-brown is also possible.

DISCUSSION.

Mr. A. G. PERKIN said that although the fact that dilute solutions of the indigotinsulphonic acids were decolorised by less permanganate than that required for the isatin reaction had been known for some time, the matter had not as yet been investigated. It was therefore apparent that the oxidation took place in two stages, and there was some possibility that the sulphonic acid of Kalb's (*Ber.*, 1909, **42**, 3642) dehydroindigotin might be produced in this manner. More striking in this respect were the sulphonic acids of indirubin, because under similar conditions the quantity of permanganate necessary for decolorisation was approximately only 75 per cent. of that calculated on the isatin equation. The primary product in the latter case was thus fairly stable in the presence of the oxidising agent, and attempts were being made to isolate it in the unsulphonated condition by the oxidation of indirubin itself.

178. "The colour and constitution of the amino-coumarins." By Arthur Clayton.

The colour of the amino-derivatives of coumarin and its homologues was shown to be independent of the position of the amino-group, and not to be due to the presence of a mobile hydrogen atom. The suggestion was made that the colour is generated by the continual breaking and reforming of valency bonds between the amino-group and the unsaturated ·O·CO· group present in the lactonic ring.

179. "Estimation of sodium and cæsium as bismuthi-nitrites. Part I. Estimation of sodium." By Walter Craven Ball.

Sodium may be estimated, even in the presence of a very large excess of potassium, by precipitation as sodium cæsium bismuthinitrite (*Trans.*, 1909, **95**, 2126). The precipitation is conducted in a special form of vessel, and the precipitate dried at 100° and weighed. The sodium present in complex mixtures, such as sea-water, may thus be estimated.

180. "The by-products of alcoholic fermentation." By Olive Eveline Ashdown and John Theodore Hewitt.

Alcohol as obtained by the fermentation of dextrose or dextrose-yielding materials by yeast contains numerous by-products. In certain cases these may be referred to substances other than dextrose, but acetic acid is probably furnished by the oxidation of acetaldehyde, which, in turn, is certainly derived from dextrose, since it is produced when pure specimens of this sugar are fermented in the presence of suitable nourishment, no other organic material being added.

The idea that the quantity of aldehyde might depend on the available nitrogen proved unfounded; incidentally, support is afforded to Ehrlich's view as to the source of the higher alcohols by the observation that addition of alanine diminishes the amount of these substances.

The amount of aldehyde may be diminished by the addition of small amounts of formates, a result of considerable interest in view of the statement of Schade (*Zeitsch. physikal. Chem.*, 1906, **57**, 1; 1907, **60**, 510) that dextrose yields acetaldehyde and a formate under the influence of alkali, whilst acetaldehyde and formic acid yield ethyl alcohol and carbon dioxide with rhodium sponge as a catalyst.

181. "Dimethoxyphenyl-*p*-tolylmethane." (Preliminary note.)

By John Edwin Mackenzie.

In previous communications (*Trans.*, 1896, **69**, 985; 1901, **79**, 1204; 1904, **85**, 790; (Clough) 1906, **89**, 771) the author and his collaborators have described the products formed by the interaction of benzophenone chloride and of benzylidene chloride on the sodium compounds of various alcohols and phenols.

It was thought that from phenyl *p*-tolyl ketone chloride a series of derivatives might be obtained according to the general equation:

$$C_6H_4Me\cdot CCl_2\cdot C_6H_5 + 2NaOR = C_6H_4Me\cdot C(OR)_2\cdot C_6H_5 + 2NaCl,$$

where R represents an alkyl group. A comparison of the physical properties of such compounds with those of the corresponding derivatives already obtained from benzophenone chloride and those to be obtained from ditolyl ketone chloride should prove interesting as showing the influence of the methyl group as a substituent of hydrogen in various positions.

Phenyl *p*-tolyl ketone was prepared by the action of benzoyl chloride on a large excess of toluene in presence of aluminium chloride according to Bourget's method (*Bull. Soc. chim.*, 1896, [iii], **15**, 945). The ketone distilled between 184° and 191°/20 mm., and crystallised out on cooling. By recrystallisation from alcohol, colourless crystals melting at 56—57° were obtained, the weight of crystals being 43 per cent. of that theoretically obtainable.

The dichloride is formed by the action of phosphorus pentachloride on the ketone: $CH_3\cdot C_6H_4\cdot COPh + PCl_5 = CH_3\cdot C_6H_4\cdot CCl_2Ph + POCl_3$. Overton (*Ber.*, 1893, **26**, 26) appears to have obtained the crude chloride. As it decomposes very readily on heating, the following method of preparation was adopted. To the ketone dissolved in ten times its weight of carbon tetrachloride, the equivalent weight of phosphorus pentachloride was added, and the mixture was then heated in a water-bath for four hours. The solvent was distilled off under 25 mm. pressure, the temperature being eventually raised to 85°.

The residual dark green oil had a strong odour of hydrogen chloride, and was very unstable in presence of water, being reconverted into the ketone.

Determinations of chlorine made at the stated intervals gave the following percentages: after one day 27·4 (theory 28·28), five days 15·35, ten days 7·8, eleven days 5·4, and on the thirteenth day crystals of the ketone separated out.

*Dimethoxy-*p*-tolylphenylmethane* was prepared by mixing the chloride with an equivalent weight of sodium methoxide in ten times its weight of methyl alcohol. A vigorous reaction took place. After filtering off the salt, the alcohol was distilled off under diminished pressure, and the residue extracted several times with ether. This ethereal solution was dried, the ether distilled off under the ordinary pressure, and the residue under a pressure of 15 mm. A colourless oil amounting to 77 per cent. of the theoretical amount passed over between 163° and 165°. (Found, $C=79·8$, $H=7·09$. Calc. $C=79·33$, $H=7·44$ per cent. M.W. by cryoscopic method = 249; Calc. 242; Density, 1·075 at 15°.)

The following boiling points were determined—186°/26 mm., 312°/80 mm.

Efforts to obtain this substance in a crystalline form were in vain, the oil only becoming more viscous. It is easily miscible with the ordinary organic solvents.

As in the case of the corresponding benzophenone derivative, this substance when placed in a desiccator containing sulphuric acid steadily lost weight until the ketone crystallised out, the change being expressed thus:

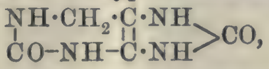
$$C_6H_4Me\cdot C(OMe)_2\cdot C_6H_5 \longrightarrow C_6H_4Me\cdot CO\cdot C_6H_5 + (CH_3)_2O.$$

Experiments with ethyl and benzyl alcohols and with phenol are in progress.

182. "A synthesis of tetrahydrouric acid."

By Edward Percy Frankland.

An attempt to synthesise the hypothetical desoxyuric acid,

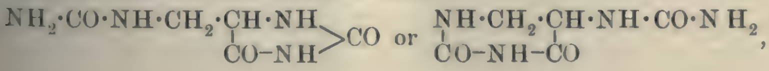


$$\begin{array}{l} NH\cdot CH_2\cdot C\cdot NH \\ CO-NH-C\cdot NH \end{array} > CO,$$

by the addition of cyanic acid to $\alpha\beta$-diaminopropionic acid,

$$NH_2\cdot CH_2\cdot CH(NH_2)\cdot CO_2H,$$

followed by the dehydration of the diurea derivative thus formed, led to the production of tetrahydrouric acid:



$$NH_2\cdot CO\cdot NH\cdot CH_2\cdot \begin{array}{l} CH\cdot NH \\ CO-NH \end{array} > CO \quad \text{or} \quad \begin{array}{l} NH\cdot CH_2\cdot CH\cdot NH\cdot CO\cdot NH_2 \\ CO-NH-CO \end{array},$$

only one molecule of water being eliminated to form a hydantoin ring.

The product from the interaction of two molecules of potassium cyanate and one molecule of diaminopropionic acid in the presence of the equivalent quantity of either hydrochloric or hydrobromic acid was evaporated with 25 per cent. hydrochloric acid, the resulting tetrahydrouric acid extracted with methyl alcohol and recrystallised from water. It melts and decomposes at 216° (uncorr.), corresponding with the substance obtained by Tafel (*Ber.*, 1901, **34**, 258) by the electrolytic reduction of uric acid.

183. "The double nitrites of mercury and the bases of the tetra-alkylammonium series." By Prafulla Chandra Rây.

The investigation on the double nitrites of mercury and the alkali metals and the metals of the alkaline earths (*Trans.*, 1907, **91**, 2031; *ibid.*, 1910, **97**, 326) has been extended to the tetra-alkylammonium series. It is well known that the tetra-alkylammonium hydroxides are fairly comparable to the alkali hydroxides in point of strength, the heat of neutralisation of any one of these bases by an equivalent of hydrochloric acid being, on an average, 13,700 calories. It was, therefore, expected that the nitrites of the alkylammonium series should also yield double salts with mercuric nitrite, and this has been found to be the case.

In the interaction of mercuric nitrite and tetra-methylammonium nitrite two distinct compounds were obtained, namely,

$$Hg(NO_2)_2,NMe_4NO_2,H_2O$$

and $Hg(NO_2)_2,2NMe_4NO_2$. The power of combination of mercuric nitrite with one or more molecules of the alkali nitrite evidently depends on the predominance of the latter in solution.*

Analysis of the compound $Hg(NO_2)_2,NMe_4NO_2,H_2O$ gave:

Found: Hg = 44·64; C = 10·71; N (nitritic) = 9·37.

$Hg(NO_2)_2,NMe_4NO_2H_2O$ requires Hg = 45·00; C = 10·63; N (nitritic) = 10·2 per cent.

The compound $Hg(NO_2)_2,2NMe_4NO_2$ gave:

Found: Hg = 38·2; C = 17·7; N (total) = 16·1.

$Hg(NO_2)_2,2NMe_4NO_2$ requires Hg = 37·6; C = 18·0; N = 15·8 per cent.

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* Although the salt $Hg(NO_2)_2,1\frac{1}{2}NaNO_2$ (*loc. cit.*) has been described, the corresponding mercuric potassium compound has not until now been obtained. The author has succeeded in preparing it in a pure state. Analysis of the salt gave:

Found: Hg = 47·72; K = 13·98; N = 11·60.

$Hg(NO_2)_2,1\frac{1}{2}KNO_2$ requires Hg = 47·66; K = 13·98; N = 11·68 per cent.

184. "Ionisation of the nitrites as measured by the cryoscopic method." (Preliminary note.) By Prafulla Chandra Rây and Satish Chandra Mukherjee.

The authors gave a preliminary account of their work on the ionisation of the nitrites. This part was carried out in the ordinary way, and the results checked by comparison experiments with potassium nitrate and chloride and sodium chloride. The nitrites were prepared either from silver nitrite or barium nitrite, and treatment with the corresponding chloride or sulphate and evaporation to dryness in a vacuum over sulphuric acid. Instead of weighing these salts directly as many were deliquescent), the authors evaporated the solutions (after the determinations had been made) with sulphuric acid and estimated the strength from the sulphate left. An exception to this was in the case of the tetramethylammonium nitrite, which was dried at 150° and weighed directly.

Salt.	Mol. wt.		Dilution in litres.	Degree of ionisation.	No. of ions.
	Calc.	Found.			
KNO_3	101·0	56·05	4·4	0·80	2
		54·37	19·0	0·86	2
KCl	74·5	38·2	15·0	0·95	2
		39·7	12·0	0·88	2
$NaCl$	58·5	31·4	4·2	0·86	2
$Ca(NO_2)_2$	132·0	49·3	28·0	0·84	3
		50·26	19·4	0·82	3
$Ba(NO_2)_2$	229·0	84·9	21·0	0·84	3
		84·0	31·4	0·86	3
$Sr(NO_2)_2$	179·3	66·43	22·0	0·84	3
		66·5	21·0	0·84	3
KNO_2	85·0	45·6	16·0	0·86	2
		46·0	17·0	0·85	2
		46·0	18·0	0·85	2
		44·4	36·0	0·91	2
$NaNO_2$	69·0	36·9	10·0	0·87	2
		36·0	20·5	0·91	2
NH_4NO_2	64·0	35·3	18·0	0·81	2
		34·2	20·0	0·87	2
$N(CH_3)_4NO_2$	120·0	63·0	14·0	0·90	2
		62·0	19·5	0·93	2
$HgCl_2$	271·0	258·6	36·6	0·47	3
$Hg(NO_2)_2$	292·0	238·2	32·0	0·11	3
$K_4Fe(CN)_6$	368·0	104·5	31·0	0·63	5
$Hg(NO_2)_2,2KNO_2$	462·0	131·4	7·2	[1·26]	3
		122·2	21·2	[1·39]	3
		110·65	60·4	[1·58]	3
$2Hg(NO_2)_2,3KNO_2$	839·0	154·0	23·0	[1·48]	3
$Hg(NO_2)_2,2N(CH_3)_4NO_2$	532·0	134·0	40·0	[1·48]	3
$Hg(NO_2)_2,Ca(NO_2)_2$	424·0	148·3	42·1	[1·86]	2
$3Hg(NO_2)_2,2Ba(NO_2)_2$	1334·0	173·7	126·0	[3·34]	3
$2Hg(NO_2)_2,HgNO_2$	830·0	294·0	64·8	[1·82]	2
		290·8	72·7	[1·85]	2
		299·5	135·2	[1·77]	2

Anomalous results are given in square brackets.

It will be seen that potassium and sodium nitrites on the one hand, and calcium, strontium, and barium nitrites on the other, show equal degrees of ionisation; thus these nitrites conform to the general rule that salts which have an analogous constitution are ionised to the same extent in dilute solutions of equal concentration.

It is worthy of note, also, that a solution of ammonium nitrite—a compound of a "weak" base and a "weak" acid—shows no deviation from the general rule, and that a solution of tetramethylammonium nitrite is far more strongly dissociated than any of the alkali nitrites, a fact in keeping with the behaviour of other salts of quaternary bases from aliphatic amines.

The results are in agreement with those obtained by other investigators using different methods.

185. "New syntheses of thioxanthone and its derivatives." By Eric Gordon Davis and Samuel Smiles.

It was shown that thioxanthone may be synthesised by warming *o*-carboxybenzenesulphinic acid and benzene with concentrated sulphuric acid; the yields furnished by this process, however, are inferior to those obtained when *o*-thiolbenzoic acid is warmed with benzene and the same condensing agent, about 80—90 per cent. of the required amount being then obtained.

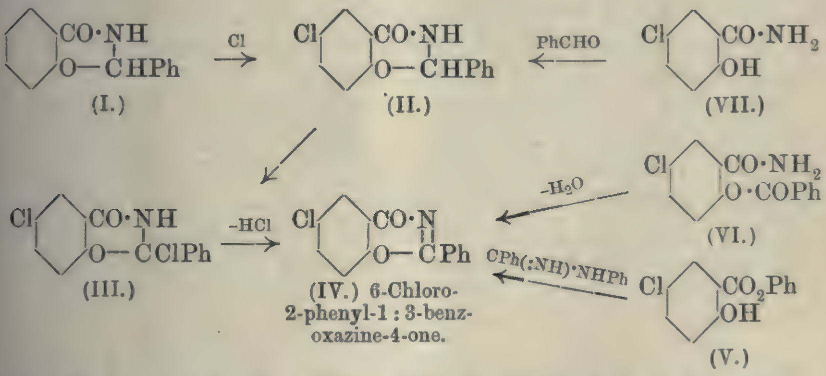
Numerous derivatives have been prepared by the latter method, and the *methyl-*, *hydroxy-*, and *methoxy-thioxanthones* were described in detail, also the preparation of *naphthathioxanthone*, *aminonaphthathioxanthone*, and *naphthabisthioxanthone* has been accomplished by this method. The mechanism of the reaction was discussed, and the conclusion was drawn that the sulphoxylic acid $(1)CO_2H\cdot C_6H_4\cdot SOH(2)$ is formed as an intermediate product.

186. "The intramolecular rearrangements of diphenylmethane ortho-sulphoxide." By Thomas Percy Hilditch and Samuel Smiles.

The *o*-sulphoxide of diphenylmethane is obtained by the interaction of hydrogen dioxide and thioxanthen. It is oxidised by potassium permanganate to diphenylmethane *o*-sulphone, and thus differs from thioxanthhydrol, which yields thioxanthone on oxidation under similar conditions. This sulphoxide is transformed by fusion, or by being warmed above its melting point in certain solvents, into thioxanthhydrol, and by acid reagents it is converted into the salts of dibenzocarbothionium. Werner's statement (*Ber.*, 1901, **34**, 3311) that thioxanthhydrol is converted by acids into the salts of that base has been confirmed, although here the change appears to be more rapid than with the sulphoxide. The study of these intramolecular changes is being continued.

187. "6-Chloro-2-phenyl-1 : 3-benzoxazine-4-one and related derivatives." By Arthur Walsh Titherley and Ernest Chislett Hughes.

The chlorination of 2-phenyldihydro-1 : 3-benzoxazine-4-one (phenylbenzometoxazone) (I) leads first to the production of the 6-chloro-derivative (m. p. 214°) (II), in which, by further action, the hydrogen atom (2) in the oxazine ring is displaced. The resulting dichloro-derivative (III), however, cannot exist, and by loss of hydrogen chloride yields the chloro-derivative (m. p. 215°) (IV) of the unsaturated cyclic compound recently isolated by Titherley (*Trans.*, 1910, **97**, 200). The unsaturated chloro-derivative (IV) has also been synthesised from phenyl 5-chlorosalicylate (V) and phenylbenzamidine, and from 5-chloro-*O*-benzoylsalicylamide (VI) by internal condensation with hydrogen chloride, whilst the simple chloro-derivative (II) has been synthesised by the condensation of 5-chlorosalicylamide (VII) and benzaldehyde:



(I.) (II.) (VII.) (VI.) (III.) (IV.) 6-Chloro-2-phenyl-1 : 3-benzoxazine-4-one. (V.)

The chloro-derivative (II) with pyridine and alkali yields the open-chain isomeride, *syn*-benzylidine-5-chlorosalicylamide,

$$OH\cdot C_6H_3Cl\cdot CO\cdot N:CHPh,$$

which is very labile, and on heating rapidly reverts to the cyclic form (II).

O-Benzoyl 5-chlorosalicylamide (VI), which may be readily obtained by the pyridine benzoylation method at − 15°, rearranges, on heating, to *N*-benzoyl 5-chlorosalicylamide, $OH\cdot C_6H_3Cl\cdot CO\cdot NH\cdot COPh$, and reversible rearrangement of the latter occurs in boiling acetic acid. The same *N*-benzoyl derivative is produced by the hydrolytic rupture of the oxazine ring in (IV) under the influence of acids.

188. "Separation of the metals of the tin group." By Robert Martin Caven.

The following modification of Walker's method (*Trans.*, 1903, **83**, 184) for the qualitative separation of the metals of the tin group has been found rapid and satisfactory. The mixed sulphides are reprecipitated from their solution in alkali, collected, washed, and boiled with concentrated hydrochloric acid according to a well-known method of separation, and the remaining arsenious sulphide, filtered off from the diluted solution, may then be identified in the usual manner by making use of its solubility in ammonium carbonate solution.

To the filtrate, free from hydrogen sulphide and containing antimonious and stannic chlorides, potassium hydroxide is added until the hydroxides precipitated are just re-dissolved in excess of alkali. Bromine water is then added until the solution remains yellow; thus antimonite, which would be hydrolysed in presence of ammonium chloride, is oxidised to antimonate.

The addition of solid ammonium chloride first causes the evolution of nitrogen, because of the hypobromite present; then stannic hydroxide separates, and, after boiling, is collected.

The filtrate contains only the antimony, which is precipitated as antimonic sulphide on acidifying and passing hydrogen sulphide.

The advantage of this scheme of analysis is that it employs Walker's excellent method of separating tin from antimony without postponing the identification of arsenic, which may result in small quantities of this element, present finally as arsenate, being missed by students.

189. "The formation and reactions of imino-compounds. Part XIII. The constitution of ethyl β-imino-α-cyanoglutarate and of its alkyl derivatives." By Arthur Fred Campbell and Jocelyn Field Thorpe.

Ethyl β-imino-α-cyanoglutarate, $CO_2Et\cdot CH_2\cdot C(NH_2)\colon C(CN)\cdot CO_2Et$, reacts entirely as an amino-compound, and appears to have no imino-phase. It is therefore a substituted ethyl glutaconate, and it is now found that in many of its reactions this amino-derivative behaves like glutaconic acid. Thus when one methyl group is introduced, ethyl β-imino-α′-cyano-α-methylglutarate,

$$CO_2Et\cdot CHMe\cdot C(NH_2)\colon C(CN)\cdot CO_2Et,$$

is formed as sole product, whereas when two methyl groups are introduced, the second methyl combines with both the α-carbon atom and the α′-carbon atom, forming ethyl β-imino-α′-cyano-αα-dimethylglutarate,

$CO_2Et\cdot CMe_2\cdot C(NH_2)\colon C(CN)\cdot CO_2Et$, and ethyl β-imino-α′-cyano-αα′-dimethylglutarate, $CO_2Et\cdot CMe\colon C(NH_2)\cdot CMe(CN)\cdot CO_2Et$, showing therefore that there is tautomerism between the α- and α′-carbon atoms as there is between the α- and γ-carbon atoms of glutaconic acid.

It has also been found that ethyl β-imino-α′-cyano-αα-dimethylglutarate can be isolated in two stereoisomeric forms, showing that the substitution of the two α-carbon atoms in ethyl β-imino-α-cyanoglutarate and the consequent "fixing" of the double bond leads, as in the derivatives of glutaconic acid, to the isolation of stereoisomeric modifications.

The production of pyrrole derivatives from the sodium compound of ethyl β-imino-α′-cyano-α-methylglutarate by the action of iodoacetonitrile was also described, the formation of these substances proving that the mobile hydrogen atom acted preferentially on the α′-carbon atom.

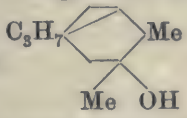
190. "*p*-Hydroxyazo-derivatives of quinoline." By John Jacob Fox.

Hydroxyazo-derivatives of quinoline, such as 5-p-*aminobenzeneazo*-8-*hydroxyquinoline*, were described, having the hydroxyl group in the ortho-position with respect to the nitrogen in the quinoline nucleus; and the properties of these substances were compared with the corresponding derivatives in which the hydroxyl group was not in the quinoline nucleus. It was shown that, whilst the latter could be acetylated and ethylated in the usual way, the former did not under ordinary conditions yield acetyl or alkyloxy-derivatives. It was pointed out that the carbonium structure for the polyhydrochlorides was inadequate to account for the marked instability of the hydrochlorides of the hydroxyazo-derivatives of 8-hydroxyquinoline as compared with quinolineazophenol.

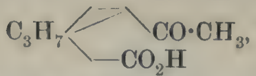
The absorption spectra show bands of which the heads occur at oscillation frequencies in about the same position as in the simpler hydroxyazo-derivatives, as, for example, dimethylaminobenzeneazophenol.

191. "A contribution to the study of tanacetone (β-thujone) and some of its derivatives." By David Thomson.

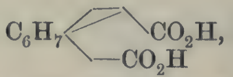
Tanacetone (β-thujone), when treated with magnesium methyl iodide, yields two tertiary homothujyl alcohols,



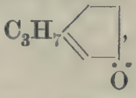
: one a solid, melting at 84°, and having $[\alpha]_D\ -30\cdot5°$; the other a liquid, boiling at 204°, and having $[\alpha]_D\ +35°$. In both these alcohols, as in thujyl alcohol, the *cyclo*propane ring is stable towards cold 5 per cent. sulphuric acid.

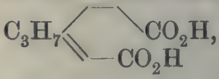
α-Thujaketonic acid, 

, is decomposed by boiling with 20 per cent. hydrochloric acid solution, with the formation of an unsaturated hydrocarbon, which in odour and boiling point is similar to dihydro-ψ-cumene.

α-Thujadicarboxylic acid, 

, prepared from α-thujaketonic acid by oxidation, is quite stable towards boiling 20 per cent. hydrochloric acid or boiling 10 per cent. sodium hydroxide. α-Thujadicarboxylic acid can be easily esterified in the ordinary way. The *dimethyl*, *diethyl*, *di*-n-*propyl*, *di*iso*butyl*, and *di*iso*amyl* esters have been prepared. All are colourless, odourless liquids.

The dimethyl and diethyl esters of α-thujadicarboxylic acid give a sodio-derivative, the decomposition products of which are tanacetophorone, 

, β-thujadicarboxylic acid, 

, and an unknown inactive dicarboxylic acid, $C_9H_{14}O_4$, melting at 150—151°.

192. "Pentane- and *iso*pentane-αβδ-tricarboxylic acids."

By Edward Hope and William Henry Perkin, jun.

These acids were prepared for the purpose of comparison with acids which had been obtained by the degradation of some new terpenes which will shortly be described. *Ethyl β-cyanopentane-αβδ-tricarboxylate*, $CO_2Et·CH_2·C(CN)(CO_2Et)·CH_2·CHMe·CO_2Et$, prepared by the action of ethyl bromoacetate on the sodium derivative of ethyl γ-cyano-α-methylglutarate, $CO_2Et·CH(CN)·CH_2·CHMe·CO_2Et$, distils at about 195—215°/17 mm., and, when digested with dilute sulphuric acid and the resulting crude acid esterified, is converted into *ethyl pentane-αβδ-tricarboxylate*. This ester distils at 178—182°/19 mm., and yields, on hydrolysis, *pentane-αβδ-tricarboxylic acid*,

$$CO_2H·CH_2·CH(CO_2H)·CH_2·CHMe·CO_2H,$$

which melts at about 158°.

*Ethyl β-cyano*iso*pentane-αβδ-tricarboxylate*,

$$CO_2Et·CH_2·C(CN)(CO_2Et)·CHMe·CH_2·CO_2Et,$$

prepared in a similar manner from ethyl γ-cyano-β-methylglutarate, $CO_2Et·CH(CN)·CHMe·CH_2·CO_2Et$, and ethyl bromoacetate, distils at about 195—215°/13 mm., and yields, on hydrolysis and subsequent esterification, *ethyl* iso*pentane-aβδ-tricarboxylate*, which distils at 180—183°/20 mm.

iso*Pentane-aβδ-tricarboxylic acid*,

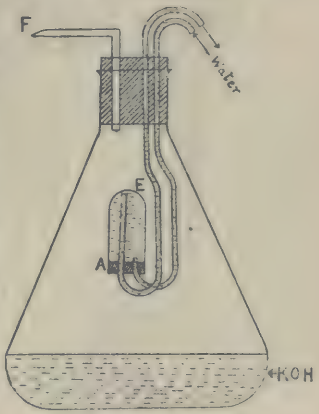
$$CO_2H{\cdot}CH_2{\cdot}CH(CO_2H){\cdot}CHMe{\cdot}CH_2{\cdot}CO_2H,$$

melts at about 154—156°.

193. "The action of pure air and water on iron and steel." (Preliminary note.) By John Albert Newton Friend.

The electrolytic theory of the corrosion of iron first advanced by Whitney in 1903 has, during the past few years, been received with increasing favour, chiefly because a considerable number of investigators, both in this country and in America, have failed to retain iron in a rust-free condition in the presence of liquid water and oxygen. The absence of rust in Moody's experiments is attributed to passivity induced by the chromic acid employed, as also to the presence of alkali dissolved out of the glass vessels containing the iron. The results of the author's own experiments (*J. Iron and Steel Inst.*, 1908, No. II, 5) are explained away in a somewhat similar manner (see W. H. Walker, *ibid.*, 1909, No I, 69; and Friend, *ibid.*, 1909, No II, 257).

In order to demonstrate the untenability of such an explanation, the following experiment has been devised, which shows in a remarkably clear and simple manner that pure water and air alone are incapable of effecting the corrosion of pure iron and steel.



AE is a hollow cylinder (of iron or steel) closed at one end. The open end is fitted to a tightly fitting rubber stopper bearing two glass tubes, as shown in the figure, and arranged in such a way that cold water can circulate freely through them. The cylinder is well polished with sand-paper, and secured as shown inside a conical flask containing about 150 c.c. of 3*N*-potassium hydroxide solution. The air is partly removed, and the vessel hermetically sealed at *F*. The flask is now placed to half its depth in a water-bath at 100°, after having been thoroughly shaken to remove every trace of carbon dioxide from its walls, etc., and a current of cold water passed through *AE*. The pressure of the air is not sufficiently reduced to allow the potash to boil, nevertheless pure water vapour condenses on *AE* and drips off, thus slowly washing it free from alkali.

After this process has been continued for several days, not a trace of alkali remains on AE, as is readily shown by opening the apparatus and testing with phenolphthalein. Nevertheless, if the iron is pure, it remains quite bright, thus proving that pure water and pure air combined are without action on pure iron. In one of the experiments two spots of rust were formed after twenty-four hours at the bend E, although the rest of the metal remained bright for several days when the apparatus was opened. This rusting was undoubtedly due to traces of slag in the metal, for on repeating the experiment, after thoroughly cleaning the iron, two spots of rust formed again in a precisely similar place. Repetition with a fresh sample of steel gave no rust whatever.

194. "*iso*Quinoline derivatives. Part V. The constitution of the reduction products of papaverine" (continued). By Frank Lee Pyman and William Colebrook Reynolds.

In Part II. of this series (*Trans.*, 1909, **95**, 1610) one of the authors showed that Goldschmiedt's "tetrahydropapaverine" was in reality a dihydropapaverine, and termed it "1 : 2-dihydropapaverine." In view, however, of the properties of its *N*-methyl derivative, the constitution of the base is regarded as unsettled. It is proposed to designate it *pavine*. N-*Methylpavine* is formed together with laudanosine by the reduction of papaverine methyl salts, and may also be obtained by the methylation of pavine; it is also formed in the oxidation of laudanosine.

The further investigation of this compound is in progress.

195. "The specific rotatory power of hyoscyamine and the relation between that of alkaloids and their salts." By Francis Howard Carr and William Colebrook Reynolds.

The specific rotatory power of pure *l*-hyoscyamine is −22·0° in 50 per cent. ethyl alcohol, whilst that of its basic ion taken in aqueous solutions of the salt is −32·5°.

Barrowcliff and Tutin (*Trans.*, 1909, **95**, 1966) stated that the lower value for the free base was due to racemisation occurring in the process of preparing it from its salts. It is now shown that racemisation does not take place so very readily as supposed by these authors—pure *d*- and *l*-hyoscyamine having $[\alpha]_D$ −22·0°—but that the specific rotatory power of hyoscyamine and of many other alkaloids differs widely from that of their respective basic ions taken in solution of a salt.

The free alkaloids behave as though they are not ionised, or only partly so, when dissolved in water or in 50 per cent. ethyl alcohol, the nitrogen retaining a triad function.

The rotatory power of a number of alkaloids and their salts has been determined, and some observations bearing upon the influence of different solvents have been made.

196. "Experiments on the Walden inversion. Part V. The interconversion of the optically active α-hydroxy-β-phenylpropionic acids." By Alex. McKenzie and Henry Wren.

The resolution of *r*-α-hydroxy-β-phenylpropionic acid into its optically active components was described.

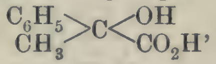
The displacement of bromine in the active α-bromo-β-phenylpropionic acids by the hydroxy-group has been examined.

The interconversion of the optically active α-hydroxy-β-phenylpropionic acids has been carried out, thus:

$$\begin{tikzcd}
d\text{-}C_6H_5{\cdot}CH_2{\cdot}CH(OH){\cdot}CO_2H \arrow[r, "\text{(by } PCl_5)"] & l\text{-}C_6H_5{\cdot}CH_2{\cdot}CHCl{\cdot}CO_2H \arrow[d, "\text{(by } CaCO_3 \text{ and water)}"] \\
d\text{-}C_6H_5{\cdot}CH_2{\cdot}CHCl{\cdot}CO_2H \arrow[u, "\text{(by } CaCO_3 \text{ and water)}"] & l\text{-}C_6H_5{\cdot}CH_2{\cdot}CH(OH){\cdot}CO_2H. \arrow[l, "\text{(by } PCl_5)"']
\end{tikzcd}$$

This is the first example recorded where phosphorus pentachloride appears to act abnormally. The isomeric acids,

$$C_6H_5{\cdot}CH(OH){\cdot}CH_2{\cdot}CO_2H,$$

$C_6H_5{\cdot}CH_2{\cdot}CH(OH){\cdot}CO_2H$, and  $\frac{C_6H_5}{CH_3}{>}C{<}\frac{OH}{CO_2H}$, thus differ from one another from the point of view of the Walden inversion.

197. "Carthamine."

By Tokuhei Kametaka and Arthur George Perkin.

It was suggested (*Proc.*, 1909, **25**, 223) that carthamine, the colouring matter of safflower, possessed the formula $C_{15}H_{14}O_7$, rather than $C_{14}H_{16}O_7$, originally assigned to it by Schlieper (*Annalen*, 1846, **58**, 362), but further experiment now indicates that the much higher formula $C_{25}H_{24}O_{12}$ is most probably correct. Carthamine, when dried in the air, crystallises with $2H_2O$, gives with dilute alcoholic potassium acetate the salt $C_{25}H_{23}O_{12}K$, green, iridescent needles, and an amorphous benzoyl compound, probably $C_{25}H_{17}O_{12}(C_7H_5O)_7$, melting at 230—232°, has been obtained. Although Schlieper obtained a yellow substance, $C_{14}H_{14}O_9$, by boiling carthamine with alcohol, and Radcliffe (*J. Soc. Dyers*, 1897, **13**, 159) noticed a similar decomposition, experiment has failed to reproduce this. When carthamine is boiled with alcoholic aniline it gives a substance $C_{25}H_{24}O_{12},C_6H_7N$, long, yellow needles, melting and decomposing at 276—278°, soluble in alkalis with a yellow colour, and for which the name *aniline xantho-carthaminate* is proposed.

β-Naphthylamine gives the compound $C_{25}H_{24}O_{12},C_{10}H_9N$, orange leaflets, melting and decomposing at 266—268°, and the corresponding derivative of ψ-cumidine forms orange leaflets, melting and decomposing at 290°. A molecular-weight determination of carthamine kindly carried out by Dr. Barger by his microscopic method gave M.W. = 551, whereas the formula $C_{25}H_{24}O_{12}$ requires M.W. = 516.

With nitric acid, carthamine gives picric acid. When digested with boiling 50 per cent. potassium hydroxide, it yields *p*-coumaric acid and *p*-hydroxybenzaldehyde, and by the prolonged action of one per cent. alkali or strong baryta water is similarly decomposed. Hydrogen peroxide in presence of sodium carbonate also produces *p*-coumaric acid, and in a similar way the crude methylation product of carthamine yields with hydrogen peroxide, *p*-methoxycinnamic acid, and probably *p*-methoxycinnamaldehyde, and with chromic acid, anisaldehyde and anisic acid.

198. "Note on gynocardin and gynocardase."
By Charles Watson Moore and Frank Tutin.

Gynocardinic acid (*Trans.*, 1905, **87**, 349), when methylated by means of dry silver oxide and methyl iodide, yields *methyl pentamethylgynocardinate*, $C_{12}H_{14}O_4(OMe)_5{\cdot}CO_2Me$, which is a liquid boiling at 220°/15 mm. No definite products could be obtained by the hydrolysis of this methyl derivative.

Gynocardin possesses feebly acidic properties, and yields compounds with the alkali metals; the *sodium* derivative has the formula $C_{13}H_{18}O_9NNa$.

The action of emulsin and of gynocardase on gynocardin, amygdalin, *l*-mandelonitrile glucoside, and salicin has been quantitatively determined.

199. "Note on quercitrin." By Charles Watson Moore.

The glucoside quercitrin is usually stated in chemical literature to possess the formula $C_{21}H_{22}O_{12}$, and its hydrolysis, with the formation of quercetin and rhamnose, has therefore been represented as follows:

$$C_{21}H_{22}O_{12} + H_2O = C_{15}H_{10}O_7 + C_6H_{14}O_6.$$

It is evident, however, that this equation cannot be correct, inasmuch as it is now known that rhamnose possesses the formula

$C_6H_{12}O_5$, but that it crystallises with one molecule of water. According to Brauns (*Arch. Pharm.*, 1904, **242**, 561), quercitrin possesses the formula $C_{21}H_{20}O_{11},2H_2O$, and its hydrolysis would therefore take place quite normally by the absorption of one molecule of water as follows :

$$C_{21}H_{20}O_{11} + H_2O = C_{15}H_{10}O_7 + C_6H_{12}O_5.$$

In the course of some experiments on quercitrin it was deemed desirable to confirm the formula assigned to it by Brauns (*loc. cit.*), and in this connexion some other observations concerning the glucoside may be recorded :

1·6548 of air-dried glucoside, when heated at 125°, lost 0·1274 H_2O. $H_2O = 7·7$.

0·1794 * gave 0·3700 CO_2 and 0·0734 H_2O. $C = 56·2$; $H = 4·5$.

$C_{21}H_{20}O_{11},2H_2O$ requires $H_2O = 7·4$ per cent.

$C_{21}H_{20}O_{11}$ requires $C = 56·2$; $H = 4·5$ per cent.

These results are thus seen to be in agreement with the formula assigned to quercitrin by Brauns (*loc. cit.*).

The melting points of carefully purified quercitrin have likewise been observed to differ considerably from those recorded in the literature. It has, for example, been stated (compare Brauns, *loc. cit.*) that the air-dried glucoside melts at 174—176°, and the anhydrous substance at 168°. The correct melting points are, however, 183—185° and 250—252° respectively.

A determination of the specific rotatory power of the air-dried glucoside gave the following result :

0·2224, made up to 20 c.c. with pyridine, gave α_D $-1°34'$ in a 1-dcm. tube, whence $[\alpha]_D$ $-140·9°$.

If to an alcoholic solution of quercitrin an excess of sodium ethoxide be added, a *trisodium* derivative is precipitated. This forms a dark yellow powder, sparingly soluble in cold alcohol :

0·2974 gave 0·0870 Na_2CO_3. $Na = 12·9$.

$C_{21}H_{17}O_{11}Na_3$ requires $Na = 13·4$ per cent.

Attempts to prepare the corresponding methyl derivative from the sodium derivative were unsuccessful, as were also those to obtain a crystalline acetyl or benzoyl derivative of quercitrin.

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* Anhydrous substance.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Abderhalden, *Emil.* [Editor.] Handbuch der biochemischen Arbeitsmethoden. Vol. III. ii. pp. 479 to 1368 + xxxii. ill. Wien 1910. (*Recd.* 22/4/10.)

From the Publishers: Messrs. Urban und Schwarzenberg.

Cameron, *Alexander Thomas.* Radiochemistry. pp. viii + 174. ill. London 1910. (*Recd.* 22/4/10.)

From the Publishers: Messrs. J. M. Dent and Sons.

Damianovich, *Horacio.* Estudio físico-químico y bio química de las materias colorantes orgánicas artificiales. pp. xvi + 526. Buenos Aires 1909. (*Recd.* 16/4/10.) From Professor R. Meldola, F.R.S.

Glaister, *John.* Poisoning by arseniuretted hydrogen or hydrogen arsenide. Its properties, sources, relations to scientific and industrial operations, symptoms, post-mortem appearances, treatment, and prevention. pp. ix + 279. ill. Edinburgh 1908. (*Recd.* 18/5/10.)

From the Publishers: Messrs. E. & S. Livingstone.

Huggins, *Sir William.* The Royal Society; or, science in the State and in the schools. pp. xv + 131. ill. London [1906]. (*Recd.* 8/4/10.) From the Author.

Jones, *Llewellyn*, and **Scard**, *Frederic J.* The manufacture of cane sugar. pp. xix + 454. ill. London 1909. (*Recd.* 26/4/10.)

From the Authors.

Lunge, *Ernest.* Compulsory working and revocation of patents. pp. vii + 89. London 1910. (*Recd.* 14/5/10.)

From the Publishers: Messrs. Stevens and Sons.

Mannheim, *E.* Toxikologische Chemie. pp. 150. ill. Leipzig 1909. (*Recd.* 11/4/10.) From the Publisher: G. J. Göschen.

Taylor, *Robert Llewellyn*, and **Wolfenden**, *J. H.* The student's chemistry. 5th edition. pp. xii + 379. ill. Manchester [1910]. (*Recd.* 28/5/10.) From the Publishers: Messrs. John Heywood Ltd.

Wolff, *Jules.* Contribution a la connaissance de divers phénomènes oxydasiques naturels et artificiels. pp. ii + 93. (*Recd.* 18/5/10.)

From the Author.

II. *By Purchase.*

Allen, *Alfred Henry.* Commercial organic analysis. Vol. II. 4th edition. Edited by *Henry* **Leffmann** and *W. A.* **Davis**. pp. x + 520. ill. London 1910. (*Recd.* 13/6/10.)

Bauer, *Max.* Edelsteinkunde. Eine allgemein verständliche Darstellung der Eigenschaften, des Vorkommens und der Verwendung der Edelsteine, nebst einer Anleitung zur Bestimmung derselben, für

Mineralogen, Edelsteinliebhaber, Steinschleifer, Juweliere. 2nd edition. pp. xvi + 766. ill. Leipzig 1909. (*Recd.* 20/4/10.)

Beckurts, *H.*, and **Lüning,** *O.* Die Methoden der Massanalyse. Part I. pp. vii + 482. ill. Braunschweig 1910. (*Recd.* 8/6/10.)

Böhm, *C. Richard.* Die Fabrikation der Glühkörper für Gasglühlicht. pp. xiii + 454. ill. Halle a.S. 1910. (*Recd.* 20/4/10.)

Dammer, *Otto.* [Editor.] Chemische Technologie der Neuzeit. Part I. pp. 192. ill. Stuttgart 1910. (*Recd.* 8/6/10.)

Desch, *Cecil H.* Metallography. pp. xi + 429. ill. London 1910. (*Recd.* 18/4/10.)

Duhem, *Pierre.* Thermodynamique et chimie. 2nd edition. pp. xii + 579. ill. Paris 1910. (*Recd.* 8/6/10.)

Felsen, *Fedor.* Der Indigo und seine Konkurrenten. Eine kritische Zusammenstellung. pp. 75. ill. Berlin 1909. (*Recd.* 20/4/10.)

Granger, *Albert.* Fabrication et emploi des matériaux et produits réfractaires utilisés dans l'industrie. pp. iv + 378. ill. Paris 1910. (*Recd.* 8/6/10.)

Hammarsten, *Olof.* Lehrbuch der physiologischen Chemie. pp. viii + 948. Wiesbaden 1910. (*Recd.* 20/4/10.)

Hilgard, *E. W.* Soils: their formation, properties, composition, and relations to climate and plant growth. pp. xxvii + 593. ill. New York 1910 [Reprint of 1906 edition]. (*Recd.* 13/6/10.)

Krüss, *Gerhard,* und **Krüss,** *Hugo.* Kolorimetrie und quantitative Spektralanalyse in ihrer Anwendung in der Chemie. 2nd edition. pp. xii + 284. ill. Hamburg und Leipzig 1909. (*Recd.* 20/4/10.)

Meyer, *Julius.* Die Allotropie der chemischen Elemente. (Sammlung, Vol. XV.) Stuttgart 1910. (*Recd.* 13/4/10.)

Pelet-Jolivet, *L.* Die Theorie des Färbeprozesses. pp. vii + 224. ill. Dresden 1910. (*Recd.* 8/6/10.)

Plotnikow, *Joh.* Photochemie. pp. viii + 182. ill. Halle a.S. 1910. (*Recd.* 20/4/10.)

Ray, *Praphulla Chandra.* A history of Hindu chemistry from the earliest times to the middle of the sixteenth century A.D. Vol. II. pp. a–q. + xcvi + 293 + 152 + xxi. Calcutta 1909. (*Recd.* 22/4/10.)

Speter, *Max.* Lavoisier und seine Vorläufer. Eine historisch-kritische Studie. (Sammlung, Vol. XV.) Stuttgart 1910. (*Recd.* 13/6/10.)

Thomson, *J. J.* The corpuscular theory of matter. pp. vii + 172. ill. London 1907. (*Recd.* 28/4/10.)

Wallach, *Otto.* Festschrift Otto Wallach zur Erinnerung an seine Forschungen auf dem Gebiete der Terpene in den Jahren 1884–1909, überreicht von seinen Schülern. pp. iv + 684. Göttingen 1909.

III. *Pamphlets.*

Annett, *Harold Edward.* The nature of the colour of black cotton soil. (From the *Mem. Dept. Agric. India,* 1910, **1**.)

Armstrong College, Newcastle-upon-Tyne. Reports on dairy investigations at Offerton Hall, County Durham, and in the North of England. pp. 146. Newcastle-upon-Tyne 1909.

Beck, *Karl,* **Löwe,** ——, and **Stegmüller,** ——. Zur Kenntnis der bleihaltigen Glasuren und deren Bleiabgabe an saure Flussigkeiten. (From the *Arbeiten. K. Gesundheitsamte,* 1910, **33**.)

Bradley, *W. P.,* and **Hale,** *C. F.* The nozzle expansion of air at high pressure. (From the *Physical Review,* 1909, **29**.)

Breinl, *Anton,* and **Nierenstein,** *M.* Bio-chemical and therapeutical studies on trypanosomiasis. (From the *Annals of Tropical Medicine,* 1909, **3**.)

Buckingham, *Edgar.* The theory of the Hampson liquefier. (From the *Bull. Bureau of Standards,* 1909, **6**.)

Burgess, *George K.* The estimation of the temperature of copper by optical pyrometers. (From the *Bull. Bureau of Standards,* 1909, **6**.)

Hewlett, *R. Tanner,* **Villar,** *Sidney,* and **Revis,** *Cecil.* On the nature of the cellular elements present in milk. (From the *J. Hygiene,* 1909, **9**.)

Hooper, *David.* The composition of Indian rice. (From the *Agric. Ledger,* 1908–09.)

—— Tamarisk manna. (From the *J. and Proc. Asiatic Soc. Bengal,* 1909, N.S. **5**.)

Ingle, *Herbert.* Cattle-feeding experiments in Britain. A review of over 200 trials made in the years 1833–1908. (From the *Trans. Highland. Agric. Soc. Scotland,* 1909–1910.)

—— Sheep-feeding experiments in Britain. A review of over 190 trials made in the years 1844–1909. (From the *Trans. Highland. Agric. Soc. Scotland,* 1910.)

Laidlaw, *P. P.* The active principle of a Bini spear poison. (From the *J. Physiol.,* 1909, **39**.)

Leather, *J. Walter.* Water requirements of crops in India. (From the *Mem. Dept. Agric. India,* 1910, **1**.)

Liljestrand, *G.* Zur Kenntnis der Einwirkung einiger Salze auf die motorischen Nervenstämme des Frosches. (From the *Skand. Archiv. Physiol.,* 1909, **22**.)

Mollison, *J.* Report on the progress of agriculture in India for 1907–09. pp. 80. Calcutta 1909.

New Zealand Department of Agriculture. *Chemistry division.* Report, 1909. Wellington 1909.

Polenske, *Eduard.* Beitrag zur Fettbestimmung in Nahrungsmitteln. (From the *Arbeiten. K. Gesundheitsamte,* 1910, **33**.)

Senier, *Alfred.* Two Academic Addresses: A visit to Giessen, and Bonn on the Rhine. 2nd edition. pp. 45. Dublin 1910.

—— The University and technical training. pp. 29. Dublin 1910.

Stewart, *J.* Report on experiments with potatoes, 1909. pp. 12. Edinburgh 1910.

Tibbals, *Charles Austin.* A study of tellurides. (From the *Bull. Univ. Wisconsin, Sci. Ser.*, 1909, **3**.)

Tuveri, *S.* Sull' azione del torio sul cuore normale ed in degenerazione grassa. (From the *Arch. Farm. sper. Sci. affini.* 1909, **8**.)

Waidner, *C. W.*, and **Burgess**, *G. K.* Platinum resistance thermometry at high temperatures. (From the *Bull. Bureau of Standards*, 1909, **6**.)

BANQUET TO PAST PRESIDENTS.

The Banquet (postponed from May 26th) will be held at the Savoy Hotel (Embankment Entrance) on Friday, November 11th, 1910, at 7 for 7.30 p.m., in honour of the following Past Presidents who have attained their Jubilee as Fellows of the Society:

	Elected	Served as President
Prof. William Odling, F.R.S.	1848	1873–1875.
The Rt. Hon. Sir Henry E. Roscoe, F.R.S.	1855	1880–1882.
Sir William Crookes, F.R.S.	1857	1887–1889.
Dr. Hugo Müller, F.R.S.	1859	1885–1887,
Dr. A. G. Vernon Harcourt, F.R.S. ...	1859	1895–1897.

The price of tickets will be One Guinea (£1 1*s.*) each (including wine), or Half-a-Guinea (10*s.* 6*d.*) each (not including wine).

All applications for tickets must be received not later than Friday, November 4th, 1910.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, made payable to "Mr. S. E. Carr," and addressed to the Assistant Secretary, Chemical Society, Burlington House, W.

THE LIBRARY.

The Library will be closed for Stocktaking from **Monday, August 8th**, until **Saturday, August 20th**, 1910, inclusive.

Fellows are particularly requested to return all Library Books in their possession not later than **Wednesday, August 3rd**.

LIST OF FELLOWS, 1910.

The List of Fellows for 1910 is now in active preparation, and changes of address received after 30th June cannot be included in it.

In order that the new list may be as complete as possible, those Fellows whose degrees and Christian names do not appear in full are requested to communicate them to the Assistant Secretary.

ERRATA.

PROCEEDINGS, 1910.

Page	Line	
91	5*	*for* "**2-methyl-1 : 3-benzoxazine-4-one**" *read* "**2-methyl-1 : 3-dihydrobenzoxazine-4-one.**"
149	6	*for* "[the late] **James Campbell Brown**" *read* "[the late] **James Campbell Brown and John Smeath Thomas.**"

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* From below.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 29/10/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 375.

The Council has ordered the following letter and report to be printed in the Journal and Proceedings of the Society:

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY,
SOUTH KENSINGTON,
LONDON, S.W.

August 22*nd*, 1910.

GENTLEMEN,

I beg to forward the Annual Report of the International Committee on Atomic Weights for 1911, to which I have appended, by their desire, the signatures of Professors Ostwald and Urbain.

The Committee, it will be seen, have acceded to the wish of the Council of the Chemical Society, and have prepared the Report in such time that it can be published prior to the commencement of the ensuing academic year.

Slight changes have been made in the atomic weights of argon, helium, krypton, lithium, neon, phosphorus, platinum, strontium, vanadium, and xenon, but otherwise the new table remains very much as in 1910.

I have the honour to be, Gentlemen,
Your obedient servant,
T. E. THORPE.

To the Hon. Secretaries,
The Chemical Society,
Burlington House,
London, W.

Report of the International Committee on Atomic Weights, 1911.

In the autumn of 1909 the Council of the Chemical Society of London voted unanimously in favour of issuing the annual report of the International Committee on Atomic Weights in September or October instead of in January as heretofore. In that proposition the Chemical Society of France has concurred, and American sentiment has also been favourable to the suggested change. Therefore the change is now made.

The reasons offered for the new policy are very simple. First, the school year, at least in most educational institutions, begins in the autumn. It is desirable that teachers should then have the latest table of atomic weights at their command, in order to avoid changes after school work has begun. Secondly, publishers of text-books are accustomed to issue their new works in the autumn, and often request early information as to changes which are likely to be made. The proposed change in the time of issuing the table is therefore an aid to teachers, students, and publishers, and no disadvantage to anyone else. The immediate usefulness of the table is increased, and to attain that end should be the main purpose of the Committee.

Since the preparation of the report for 1910, a number of important memoirs upon atomic weights have appeared. The results obtained are, in brief, as follows:

Chlorine.—The density, composition by volume, and compressibility of hydrochloric acid have been measured by Gray and Burt (Trans., 1909, **95**, 1633) with great care. From the density and volumetric composition, when $H = 1·00762$, $Cl = 35·459$. From the density and compressibility, $Cl = 35·461$. The mean, 35·460, is the value given in the annual table of atomic weights for the past two or three years.

The density of hydrochloric acid has also been determined by Scheuer (*Zeitsch. physikal. Chem.*, 1909, **68**, 575), who gives measurements made under varying conditions. His final conclusion, based upon his own work after comparison with that of Gray and Burt, is that $Cl = 35·466$.

Lithium.—Richards and Willard (*J. Amer. Chem. Soc.*, 1910, **32**, 4), in their important research upon the atomic weight of lithium, measured three distinct ratios, namely, silver to lithium chloride, silver chloride to lithium chloride, and lithium perchlorate to lithium chloride. From these ratios, without the intervention of any others, the following independent values for three atomic weights are obtained:

Li = 6·939.
Cl = 35·454.
Ag = 107·571.

The value for silver varies from the accepted value, 107·88, by about one part in 12,000, which is probably less than the actual uncertainty. That for chlorine diverges more widelv, namely, by about one part in 6000. The new figures are undoubtedly entitled to great weight, but in view of the excellent work done by others it would be unwise to make any hasty change in the table. For lithium, however, the value 6·94 may be taken, replacing the old 7·00.

Strontium.—Thorpe and Francis (*Proc. Roy. Soc.*, 1910, **83**, *A*, 277), in their determinations of the atomic weight of strontium, measured six ratios, and obtained the following results:

Ratio 2Ag to $SrBr_2$	Sr = 87·645
,, 2AgBr to $SrBr_2$	,, = 87·653
,, 2Ag to $SrCl_2$	,, = 87·642
,, 2AgCl to $SrCl_2$	,, = 87·645
,, $SrBr_2$ to $SrSO_4$...........	,, = 87·629
,, $SrCl_2$ to $SrSO_4$...........	,, = 87·661
Mean of all	Sr = 87·646

The value adopted by the authors is 87·65. Richards's figure is 87·62. An intermediate value, 87·63, is adopted in the new table.

Phosphorus.—Atomic weight redetermined by Baxter and Jones (*J. Amer. Chem. Soc.*, 1910, **32**, 298). From the ratio between silver and silver triphosphate, the authors find P = 31·043, when Ag = 107·88. The rounded-off figure 31·04 is to be adopted.

Vanadium.—From the ratio between silver chloride and vanadyl trichloride, Prandtl and Bleyer (*Zeitsch. anorg. Chem.*, 1910, **65**, 152) find V = 50·963 and 51·133 in two series of experiments. In a later paper, Prandtl and Bleyer (*Zeitsch. anorg. Chem.*, 1910, **67**, 257), also from analyses of vanadyl trichloride, find V = 51·061. From reductions of V_2O_5 to V_2O_3, they found V = 51·374. The latter method, however, they regard as uncertain. The value V = 51·06 may be provisionally adopted.

Tellurium.—Marckwald and Foizik (*Ber.*, 1910, **43**, 1710; see also Browning and Flint, *Amer. J. Sci.*, 1909, [iv], **28**, 347, who adduce evidence to show that tellurium is possibly complex), by a somewhat complex volumetric process, based on the oxidation of TeO_2 by $KMnO_4$, conclude that Te = 127·61. This agrees with many of the other recent determinations of the constant, but is not sufficiently exact to supplant the value given in the table.

Rhodium.—Two inaugural dissertations upon the atomic weight of rhodium have been issued from Gutbier's laboratory at Erlangen. Renz reduced rhodium pentamine bromide in hydrogen and found Rh = 102·92. H. Dittmar (reproduced in *Sitzungsber. phys. med. Soz. Erlangen*, **40**, 184), by similar reductions of the corresponding chloride, found Rh = 102·93.

Platinum.—The very elaborate investigation of Archibald (*Proc. Roy. Soc. Edin.*, 1909, **29**, 721) upon the atomic weight of platinum was based upon analyses of the chloroplatinates and bromoplatinates of potassium and ammonium. In all, 28 ratios were measured, giving values for Pt ranging between 195·19 and 195·25. Their arithmetical mean gives Pt = 195·22. Archibald, however, in his final discussion, uses only 12 ratios, giving, in mean, Pt = 195·23. The figure 195·2 is given in the table.

The Inert Gases.—The densities and molecular weights of helium and neon have been redetermined by Watson (Trans., 1910, **97**, 810). For the atomic weights he finds He = 3·994 and Ne = 20·200. In another paper (*ibid.*, **97**, 833) he applies the critical constants of krypton and xenon to their densities as determined by Moore, and finds Kr = 82·92 and Xe = 130·22. There are also new determinations of the density of argon by Fischer and Hehnel (*Ber.*, 1910, **43**, 1435). Their mean value, referred to O = 16, is 19·945, a figure rather higher than that given by Ramsay and Travers. It corresponds to an atomic weight of A = 39·89.

It is also to be noted that a third, revised edition of Clarke's "Recalculation of the Atomic Weights" has recently been published by the Smithsonian Institution.

The annual table of atomic weights for 1911 follows, with but few changes from that of the preceding year.

F. W. Clarke.
W. Ostwald.
T. E. Thorpe.
G. Urbain.

1911.

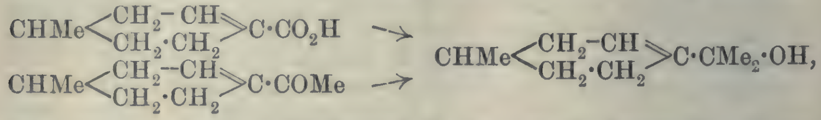
International Atomic Weights.

		O=16.
Aluminium	Al	27·1
Antimony	Sb	120·2
Argon	A	39·88
Arsenic	As	74·96
Barium	Ba	137·37
Bismuth	Bi	208·0
Boron	B	11·0
Bromine	Br	79·92
Cadmium	Cd	112·40
Cæsium	Cs	132·81
Calcium	Ca	40·09
Carbon	C	12·00
Cerium	Ce	140·25
Chlorine	Cl	35·46
Chromium	Cr	52·0
Cobalt	Co	58·97
Columbium	Cb	93·5
Copper	Cu	63·57
Dysprosium	Dy	162·5
Erbium	Er	167·4
Europium	Eu	152·0
Fluorine	F	19·0
Gadolinium	Gd	157·3
Gallium	Ga	69·9
Germanium	Ge	72·5
Glucinum	Gl	9·1
Gold	Au	197·2
Helium	He	3·99
Hydrogen	H	1·008
Indium	In	114·8
Iodine	I	126·92
Iridium	Ir	193·1
Iron	Fe	55·85
Krypton	Kr	82·9
Lanthanum	La	139·0
Lead	Pb	207·10
Lithium	Li	6·94
Lutecium	Lu	174·0
Magnesium	Mg	24·32
Manganese	Mn	54·93
Mercury	Hg	200·0
Molybdenum	Mo	96·0
Neodymium	Nd	144·3
Neon	Ne	20·2
Nickel	Ni	58·68
Nitrogen	N	14·01
Osmium	Os	190·9
Oxygen	O	16·00
Palladium	Pd	106·7
Phosphorus	P	31·04
Platinum	Pt	195·2
Potassium	K	39·10
Praseodymium	Pr	140·6
Radium	Ra	226·4
Rhodium	Rh	102·9
Rubidium	Rb	85·45
Ruthenium	Ru	101·7
Samarium	Sa	150·4
Scandium	Sc	44·1
Selenium	Se	79·2
Silicon	Si	28·3
Silver	Ag	107·88
Sodium	Na	23·00
Strontium	Sr	87·63
Sulphur	S	32·07
Tantalum	Ta	181·0
Tellurium	Te	127·5
Terbium	Tb	159·2
Thallium	Tl	204·0
Thorium	Th	232·0
Thulium	Tm	168·5
Tin	Sn	119·0
Titanium	Ti	48·1
Tungsten	W	184·0
Uranium	U	238·5
Vanadium	V	51·06
Xenon	Xe	130·2
Ytterbium (Neoytterbium)	Yb	172·0
Yttrium	Y	89·0
Zinc	Zn	65·37
Zirconium	Zr	90·6

The following are abstracts of papers received during the vacation and published or passed for publication in the *Transactions*:

200. "Δ^3-*p*-Menthenol(8) and Δ-$^{3:8(9)}$-*p*-menthadiene." By William Henry Perkin, jun., and Otto Wallach. (Trans., 1910, 1427.)

The authors have prepared the above substances and several of their derivatives from two sources, namely, from 1-methyl-Δ^3-*cyclo*hexene-4-carboxylic acid and from 4-acetyl-1-methyl-Δ^3-*cyclo*hexene:



$$\begin{matrix} CHMe\left<\begin{matrix}CH_2-CH\\CH_2\cdot CH_2\end{matrix}\right>C\cdot CO_2H \rightarrow \\ CHMe\left<\begin{matrix}CH_2-CH\\CH_2\cdot CH_2\end{matrix}\right>C\cdot COMe \rightarrow \end{matrix} \quad CHMe\left<\begin{matrix}CH_2-CH\\CH_2\cdot CH_2\end{matrix}\right>C\cdot CMe_2\cdot OH,$$

and they give a careful comparison of the physical properties of these substances with those of terpineol, limonene, and their corresponding derivatives.

201. "Freezing-point curve for mixtures of camphor and phenol." By John Kerfoot Wood and Janet Drummond Scott. (Trans., 1910, 1573.)

The authors have determined the freezing points of a large number of mixtures of camphor and phenol, ranging in composition from pure phenol on the one hand to pure camphor on the other. The form of the freezing-point curve indicates the formation of a compound, the freezing point of which is −18·6°, between equimolecular proportions of camphor and phenol. The curve also shows that eutectic mixtures are produced when the molecular percentage of camphor in the mixture amounts to either 29·5 or 59·21; in the former case the eutectic mixture is composed of phenol and the compound, and in the latter case of camphor and the compound. The freezing points of the two eutectic mixtures are respectively −30·5° and −32·0°.

No evidence was obtained by the authors as to the existence of the hemi-camphoride of phenol mentioned by Léger (*Compt. rend.*, 1890, **111**, 109).

202. "The absorption spectra of aniline and its homologues as vapours, as liquids, and in solution." By John Edward Purvis. (Trans., 1910, 1546.)

The results of this investigation show that: (1) the vapour of aniline has a considerable number of absorption bands, which show relationships amongst themselves both in structure and in differences of wave-lengths; (2) the vapours of the homologues of aniline show none of these absorption bands; (3) the solutions in alcohol show absorption bands in all the substances, and the type and position of the bands are regulated by the replacement, by alkyl groups, of the hydrogen in the amino-group or in the nucleus; (4) none of the substances in the liquid condition exhibit absorption bands through the thinnest films of 0·001 mm. thick. The phenomena are discussed from a consideration of the vibrations of symmetrically and unsymmetrically oriented molecules in different physical conditions.

203. "Condensations of phenanthraquinone with ethyl malonate and ethyl acetoacetate." By Marion Brock Richards. (Trans., 1910, 1456.)

Japp and Wood (*Trans.*, 1905, **87**, 712) described some condensations of phenanthraquinone with ketonic compounds under the influence of acetic anhydride containing a little concentrated sulphuric acid.

The condensation products of phenanthraquinone with ethyl malonate and with ethyl acetoacetate, of which mention was made in that paper, have now been further investigated.

In the case of the ethyl malonate reaction, two compounds were obtained, namely, *ethyl phenanthroxylacetoxymalonate*, $C_{23}H_{22}O_7$ (m. p. 109·5°), and *ethyl 2-keto-3-acetoxy-*4 : 5-*diphenylene*-2 : 3-*dihydrofuran*-3-*carboxylate*, $C_{21}H_{16}O_6$ (m. p. 163·5°), and it was found that the former could be transformed into the latter compound by further action of the reagent. Reduction of the second compound with hydriodic acid yielded 2-*keto*-4 : 5-*diphenylene*-2 : 3-*dihydrofuran*, $C_{16}H_{10}O_2$ (m. p. 177°), from which the corresponding acid, 9-*hydroxy*-10-*phenanthrylacetic acid*, $C_{16}H_{12}O_3$ (m. p. 182—183°), was also prepared.

The ethyl acetoacetate reaction also gave two compounds, namely, *ethyl* 9-*phenanthroxylacetoxyacetoacetate*, $C_{22}H_{20}O_6$ (m. p. 148°), and a *substance*, $C_{22}H_{18}O_5$ (m. p. above 315°), and, again, further action of the reagent caused the first substance to be transformed into the second.

204. "The constitution and mutarotation of sugar anilides." By James Colquhoun Irvine and David McNicoll. (Trans., 1910, 1449.)

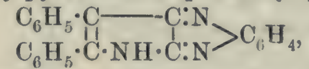
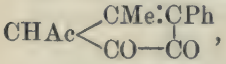
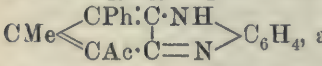
The anilides of tetramethyl mannose, tetramethyl galactose, and trimethyl rhamnose have each been obtained crystalline in mutarotatory forms. The compounds are recovered unchanged after treatment with silver oxide and methyl iodide, and are thus to be regarded as derivatives of the γ-oxidic forms of the parent sugars.

As the anilides of the corresponding unsubstituted sugars are very readily hydrolysed, the method of determining their constitution by the results of alkylation (*Trans.*, 1908, **93**, 1429) cannot be applied, but their structural resemblance to the methylated γ-oxidic anilides is shown in the mutarotation exhibited by the compounds. Mannoseanilide, galactoseanilide, and rhamnoseanilide have accordingly been re-examined, and found to display optical changes which are comparable in every way with those shown by the methylated anilides.

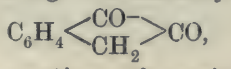
Comparison of the optical effects due to glucoside and anilide formation, from sugars, and from methylated sugars, shows that the forms of the anilides isolated in the pure state by crystallisation are directly comparable with β-glucosides.

205. "Cyclic di- and tri-ketones." By Siegfried Ruhemann.

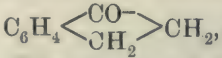
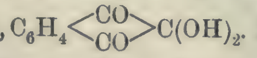
(Trans., 1910, 1438.)

The diketopyrrolines condense with *o*-phenylenediamine with the production of phenazines. Diketodiphenylpyrroline and diketophenyl-*p*-tolylpyrroline, respectively, yield thus: *diphenylpyrrolinophenazine*,  $\begin{matrix}C_6H_5\cdot C\text{———}C{:}N\\ C_6H_5\cdot C\cdot NH\cdot C{:}N\end{matrix}\!>\!C_6H_4$, or its homologue. These compounds, like all other members of this group, are yellow, but the condensation product, $C_{20}H_{16}ON_2$, which is formed from *o*-phenylenediamine and diketoacetylphenylmethyl*cyclo*pentene,  $CHAc\!<\!\begin{matrix}CMe{:}CPh\\ CO\text{—}CO\end{matrix}$, is purple. This fact indicates that the substance $C_{20}H_{16}ON_2$ has not the constitution of the phenazines, but  $CMe\!<\!\begin{matrix}CPh{:}C\cdot NH\\ CAc\cdot C\text{==}N\end{matrix}\!>\!C_6H_4$, and that its formation is preceded by the change of the diketo*cyclo*pentene derivative, $C_{14}H_{12}O_3$, into its tautomeric form, which exists, also, in the blue salts of this diketone (see *Trans.*, 1909, **95**, 984).

With the view of preparing 1 : 2-diketohydrindene,



$$C_6H_4\!<\!\begin{matrix}CO\text{—}\\ CH_2\end{matrix}\!>\!CO,$$

the author studied the action of *p*-nitrosodimethylaniline on α-hydrindone,  $C_6H_4\!<\!\begin{matrix}CO\text{—}\\ CH_2\end{matrix}\!>\!CH_2$, and found that the nitroso-compound attacks both CH_2 groups of the hydrindone. The green condensation product, $C_{25}H_{26}O_2N_4$, which is formed, is decomposed by dilute sulphuric acid, and yields the colourless *hydrate* of *triketohydrindene*,  $C_6H_4\!<\!\begin{matrix}CO\\ CO\end{matrix}\!>\!C(OH)_2$. Its physical properties and some of its interesting reactions are described.

206. "The relation between solubility and the physical state of the solvent in the case of the absorption of carbon dioxide in *p* azoxyphenetole." By Ida Frances Homfray. (Trans., 1910, 1669).

A homogeneous solution phase, in the normal liquid or gaseous states, may be present in equilibrium with practically all solids, liquids, or gases in other co-existing phases. In the case of mixtures in the so-called solid state, however, a distinction must be drawn between the crystalline and the amorphous forms. The term solid should, strictly speaking, be confined to the former, the latter having rather the properties of a highly supercooled fluid. All available evidence appears to show that the directive forces of crystallisation almost entirely prevent molecular interpenetration. *p*-Azoxyphenetole is a crystalline substance, which melts at 138° to a crystalline liquid, changing at 165° to an isotropic normal liquid. The absorption of carbon dioxide in these phases has been determined in a specially constructed apparatus, unabsorbed gaseous volumes being measured. It was found that no absorption takes place in the solid, crystalline phase. After the first melting point, some absorption occurs. On further raising the temperature, thermal expansion continues until the clearing point is reached. Then, however, a second maximum volume is passed through, a very considerable increase of absorption occurring. After equilibrium has again been established, thermal expansion and decrease of solubility proceed regularly. On reversing the process, the same maximum and minimum readings are repeated.

The remarkable result is thus obtained that, in spite of the lower temperature of the crystalline liquid phase, its solvent power is much smaller than that of the isotropic phase, whilst solution or adsorption in the solid phase is entirely absent.

207. "The triazo-group. Part XIV. Azoimides of the acetoacetic series." By Martin Onslow Forster and Sidney Herbert Newman. (Trans., 1910, 1360).

For the purpose of comparison with azoimides of the malonic series, *methyl* and *ethyl α-triazomethylacetoacetates*, *ethyl α-triazoethylacetoacetate*, and *ethyl αα-bistriazoacetoacetate* were prepared by interaction of the corresponding chloro-derivatives and sodium azide. In each case the triazo-ester was obtained with much greater difficulty than was presented by the triazomalonic esters.

Ethyl α-triazomethylacetoacetate is transformed by ammonia into α-triazopropionamide, whilst hydrochloric acid resolves it into diacetyl.

208. "Optically active methoxysuccinic acid from malic acid." By Thomas Purdie and George Ballingall Neave. (Trans., 1910, 1517).

The authors have prepared the methyl, ethyl, and propyl esters of *l*-methoxysuccinic acid by methylating malic esters with methyl iodide and silver oxide with the object of controlling and extending the polarimetric observations formerly made (*Trans.*, 1893, **63**, 217, and succeeding papers) on the same compounds, obtained by resolution of inactive methoxysuccinic acid with the aid of alkaloids. The values of the rotatory powers of the esters and acid from the two different sources are in fair agreement.

The optical relationships of the ethereal *l*-methoxysuccinates with the *d*-dimethoxysuccinates (*Trans.*, 1901, **79**, 963), in the pure liquid state and in solution, are pointed out, also the relationships of these esters with the parent malates and tartrates.

The diamide and dianilide of *l*-methoxysuccinic acid were prepared, and their rotatory powers in solution compared with those of maldiamide and maldianilide in similar solvents.

209. "Optically active derivatives of *l*-methoxy- and *d*-dimethoxysuccinic acids." By Thomas Purdie and Charles Robert Young. (Trans., 1910, 1524).

The authors have prepared further derivatives of these acids, including the anhydrides and dichlorides. Polarimetric examination of the latter afforded no evidence that they were mixtures of two tautomeric forms of the type frequently assigned to succinyl chloride. The molecular rotations of *l*-methoxysuccinic acid and a number of its derivatives approximate to the halved values of the corresponding dimethoxy-compounds. It is pointed out that the movements of rotation attending the conversion of alkyloxy-, acyloxy-, and halogen-succinic acids of *d*- and *l*-configuration into chloride, ester, and anhydride are always in the dextro- and lævo-direction respectively, irrespective of the sign of rotation of the initial acid.

The action of sodium methoxide on methyl *l*-methoxysuccinate gave an optically inactive condensation compound, apparently identical with a substance obtained similarly (*Trans.*, 1891, **59**, 472) from methyl fumarate. The products of the action of magnesium methyl iodide and of magnesium phenyl bromide on methyl *d*-dimethoxysuccinate were *γδ-dimethoxy-βε-dimethylhexane-βε-diol* (m. p. 71°) and 3 : 4-*dimethoxy*-2 : 2 : 5 : 5-*tetraphenyltetrahydrofuran* (m. p. 185°) respectively; both compounds are lævorotatory.

210. "Action of Grignard reagents on methyl *l*-methoxysuccinate methyl maleate, and maleic anhydride." By Thomas Purdie and Paul Seidelin Arup. (Trans., 1910, 1537).

The action of magnesium methyl iodide on methyl *l*-methoxysuccinate is similar to that of the same reagent on the *d*-dimethoxy-ester previously described, the product being optically active γ-methoxy-$\beta\epsilon$-dimethylhexane-$\beta\epsilon$-diol. Dehydration, however, occurred in the course of isolating the compound by distillation, and the final product obtained was the oxide of the glycol, or possibly an isomeric unsaturated alcohol. The substance is dextrorotatory.

Two crystalline compounds were isolated from the product of the action of magnesium phenyl bromide on methyl *l*-methoxysuccinate, namely, 2 : 2 : 5 : 5-*tetraphenyl*-2 : 5-*dihydrofuran* (m. p. 190—191°) and a *triphenylbutyrolactone* (m. p. 160—161°), both optically inactive. The latter compound, on being heated with mineral acids, was converted into an isomeric lactone (m. p. 197°). With the view of elucidating the reactions concerned in the production of these compounds, the authors examined the action of magnesium phenyl bromide on methyl fumarate and maleate and on maleic anhydride. The product in the case of methyl fumarate was an uncrystallisable oil from which no pure substance could be isolated. Methyl maleate gave the above-mentioned dihydrofuran derivative, and maleic anhydride gave A. Smith's desylacetophenone (*Trans.*, 1890, **57**, 643).

211. "The intramolecular rearrangement of diphenylamine ortho-sulphoxides. Part III. The tri- and tetra-chlorosulphoxides." By Oscar Lisle Brady and Samuel Smiles. (Trans., 1910, 1559).

In a previous paper the mechanism of this rearrangement was discussed, and the hypothesis was advanced that it depends on the preliminary formation of a salt of the sulphoxide. The tri- and tetrachloro-sulphoxides of diphenylamine have now been prepared by the action of hydrogen dioxide and hydrochloric acid on thiodiphenylamine, and these have been fully investigated with the object of isolating their salts. This has been accomplished in the case of the trichloro-derivative, the hydrochloride of which is readily converted into the azothionium compound by warming in certain media. It is considered that the explanation previously given to this reaction is thus confirmed.

212. "The rate of hydration of acid anhydrides: succinic, methylsuccinic, itaconic, maleic, citraconic, and phthalic." By Albert Cherbury David Rivett and Nevil Vincent Sidgwick. (Trans., 1910, 1677).

The authors have investigated the rate of hydration of these anhydrides by means of the conductivity, by a method described for acetic anhydride in a previous paper (*Trans.*, 1910, **97**, 732). In all cases the reaction was found to be unimolecular, and not to be catalysed by hydrogen ions. The slight variation of the rate with concentration, previously found with acetic anhydride, was not observed with any of these cyclic anhydrides, with the possible exception of methylsuccinic. The velocities are given below (the mean value for acetic anhydride being added for comparison), together with the dissociation constants of the corresponding acids:

Anhydride.	Velocity constant.		Dissociation constant of acid.	
	Absolute.	Relative.	Absolute.	Relative.
[Acetic	0·001148	0·99]		
Succinic	0·001155	**1·00**	0·0066	**1·00**
Methylsuccinic	0·001609	1·39	0·0086	1·30
Itaconic (Methylenesuccinic)	0·001294	1·12	0·012	1·82
Maleic	0·0115	9·96	1·2	182
Citraconic (Methylmaleic)	0·00765	6·62	0·34	51·5
Phthalic	0·00461	3·99	0·121	18·3

It will be seen that succinic anhydride, with its saturated, five-membered ring, which on Baeyer's theory has practically no strain, is hydrated with almost the same velocity as the open-chain acetic anhydride. The velocity is greatly increased by a double link, less by a benzene link. With the exception of methylsuccinic anhydride, the order of the velocities is the same as that of the dissociation constants. The introduction of a methyl group raises the velocity of succinic anhydride and lowers that of maleic; it has the same effect on the dissociation constants of the corresponding acids.

213. "Ethyl 6-methyl-2-pyrone-3:5 dicarboxylate and its conversion into methyltrimesic acid." By John Lionel Simonsen. (Trans., 1910, 1910.)

Ethyl 6-methyl-2-pyrone-3: 5-dicarboxylate (*Trans.*, 1908, **93**, 1022), on hydrolysis, is converted into *methyltrimesic acid*, which on oxidation gives prehnitic acid. The condensation of ethyl propiolate and ethyl acetoacetate was also investigated.

214. "The action of bases on αβ-dibromobutyric acid and its esters." By Thomas Campbell James. (Trans., 1910, 1565).

The action of various alkalis, tertiary bases, and alkaloids in abstracting hydrogen bromide from αβ-dibromobutyric acid has been examined. The reaction of the acid with aqueous potassium hydroxide has been followed kinetically and shown to be strictly bimolecular.

In the case of all the bases used, the product consists of a mixture of α-bromo- and α-bromo*allo*-crotonic acids, the proportion of the former being greater the weaker the base used.

When esters are used instead of the free acid, the proportion of α-bromo-acid is not increased to anything like the same degree as in the case of the analogous decomposition of αβ-dibromo-β-phenylpropionic acid (cinnamic acid dibromide).

215. "The absorption spectra of furan, furfuraldehyde, thiophen, and pyrrole under different conditions." By John Edward Purvis. (Trans., 1910, 1648).

The results of the investigation are: (1) The vapour of furan exhibits absorption bands, some of which are similar in appearance and have similar differences in wave-lengths; the vapour of furfuraldehyde also exhibits bands which can be grouped together, but which are different from those of furan; the vapours of thiophen and pyrrole show a few bands, two of which are comparable with two in the vapours of furan and of furfuraldehyde. (2) Alcoholic solutions of furan, thiophen, and pyrrole show no absorption bands, whilst a $N/1000$-solution of furfuraldehyde shows a strong band in the ultra-violet. (3) The liquids, furfuraldehyde, thiophen, and pyrrole, show no absorption bands.

216. "The viscosity of certain amides." By Albert Ernest Dunstan and Albert George Mussell. (Trans., 1910, 1935).

The authors have determined the viscosities of a considerable number of amides in the free state in aqueous solution and in pyridine solution. They find that in aqueous solution the simple fatty amides are still associated to a considerable extent, and that formamide is largely dissociated. The amides in the fused condition are associated, but whilst acetanilide has a high molecular viscosity, pointing to great association, methylacetanilide exists in a much more simple molecular condition. In pyridine solution the amides show little signs of the acidic character which would be expected did they possess the hydroxyiminic structure. With the exceptions of thiocarbamide, diphenylthiocarbamide, and cyanuric acid, the molecular viscosities are normal.

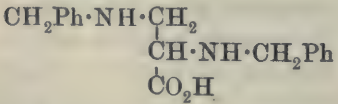
217. "Changes in volume in the formation of dilute solutions. Part II. Relationship between change in volume and constitution." By Harry Medforth Dawson. (Trans., 1910, 1896).

It is shown that the change in volume which accompanies the formation of dilute solutions of a given substance in a series of solvents is determined by the internal pressures and the compressibilities of the solvents provided that the formation of the solution is unaccompanied by changes in the degree of complexity of the solute and solvent, and that the two kinds of molecules do not enter into combination. Such solutions are termed "normal" solutions. Experimental observations relating to iodine solutions indicate that combination between iodine and the solvent is of frequent occurrence. Since this combination is accompanied by an alteration in volume, the observed changes in volume in the formation of iodine solutions are not as a rule in agreement with the requirements of the equation deduced for "normal solutions." In some few cases, however, the relative volume changes are such as are anticipated by theory.

The absence of parallelism in the volume changes when two substances are dissolved in the same series of solvents is also consistent with the view that solvates are usually formed in dilute solutions.

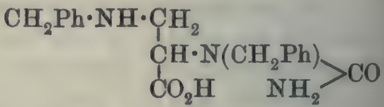
218. "*αβ*-Dibenzylaminopropionic acid and 1 : 7-dibenzyltetrahydrouric acid." By Edward Percy Frankland. (Trans., 1910, 1686).

Following the method adopted by the author in the recent synthesis of tetrahydrouric acid, a dibenzyltetrahydrouric acid was prepared by the action of cyanic acid on *αβ-dibenzylaminopropionic* acid (I), one of the carbamide groups being condensed with the carboxyl group by means of 25 per cent. hydrochloric acid:



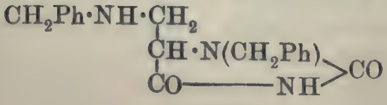
$$\begin{array}{l} CH_2Ph\cdot NH\cdot CH_2 \\ \qquad\qquad\quad | \\ \qquad\qquad\quad CH\cdot NH\cdot CH_2Ph \\ \qquad\qquad\quad | \\ \qquad\qquad\quad CO_2H \end{array}$$

(I.)



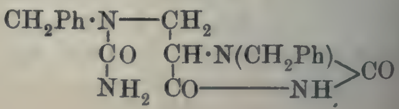
$$\begin{array}{l} CH_2Ph\cdot NH\cdot CH_2 \\ \qquad\qquad\quad | \\ \qquad\qquad\quad CH\cdot N(CH_2Ph){\Large >}CO \\ \qquad\qquad\quad | \qquad\qquad NH_2 \\ \qquad\qquad\quad CO_2H \end{array}$$

(II.)



$$\begin{array}{l} CH_2Ph\cdot NH\cdot CH_2 \\ \qquad\qquad\quad | \\ \qquad\qquad\quad CH\cdot N(CH_2Ph){\Large >}CO \\ \qquad\qquad\quad | \\ \qquad\qquad\quad CO\text{———}NH \end{array}$$

(III.)



$$\begin{array}{l} CH_2Ph\cdot N\text{——}CH_2 \\ \qquad\qquad\;\; | \qquad\;\; | \\ \qquad\qquad\; CO \quad CH\cdot N(CH_2Ph){\Large >}CO \\ \qquad\qquad\;\; | \qquad\;\; | \\ \qquad\qquad\; NH_2 \;\; CO\text{———}NH \end{array}$$

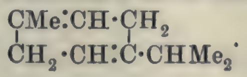
(IV.)

The first product of the action of cyanic acid on the dibenzylaminopropionic acid was probably *β-benzylamino-α-benzylcarbamidopropionic acid* (II) (m. p. 200—201°), which was condensed with hydrochloric acid to *β-benzyl-γ-benzylaminomethylhydantoin* (III) (m. p. 112—115°). One of the benzylamino-groups remained unacted on, and was capable of salt formation with a molecule of hydrochloric acid. The free base was converted into 1 : 7-*dibenzyltetrahydrouric acid* (IV) by prolonged heating with an excess of potassium cyanate in aqueous methyl alcohol; it forms prismatic crystals, melting with slight decomposition at 177—178° (uncorr.).

The αβ-dibenzylaminopropionic acid was obtained by boiling a solution of benzylamine in chloroform with αβ-dibromopropionic acid. The free dibenzylamino-acid is sparingly soluble in water with an alkaline reaction to litmus; it forms rhomboidal plates, melting and decomposing at 181—184° (uncorr.).

219. "**Contributions to the chemistry of the terpenes. Part VII. Synthesis of a monocyclic terpene from thymol.**" **By George Gerald Henderson and Maggie Millen Jeffs Sutherland.** (Trans., 1910, 1616).

From thymol, $C_6H_3MePr^{\beta}\cdot OH$, the authors prepared thymoquinone, which, on reduction with sulphuric acid, yielded thymoquinol, $C_6H_2MePr^{\beta}(OH)_2$. This dihydric phenol, when heated with hydrogen in presence of nickel according to the method of Sabatier and Senderens, was converted into the saturated disecondary alcohol, *menthane*-2 : 5-*diol*, $C_{10}H_{18}(OH)_2$. This compound forms very small, colourless crystals. It melts at 112° and boils at about 155°/15 mm. It is very readily soluble in alcohol, ether, or light petroleum, readily so in benzene, and very sparingly so in water. When heated at 110—200° with anhydrous potassium hydrogen sulphate, it yields a *terpene*, $C_{10}H_{16}$, which is a colourless liquid, boiling at 179°/760 mm. It has a rather faint odour somewhat like that of limonene, and is practically insoluble in water, but readily soluble in the usual organic solvents. It at once reduces permanganate, and unites additively with bromine, but apparently does not react with nitrous acid to form a nitrosite. It is probably

$\Delta^{1:4}$-menthadiene,

$$\begin{array}{l} CMe{:}CH\cdot CH_2 \\ | \qquad\quad\ \ | \\ CH_2\cdot CH{:}C\cdot CHMe_2 \end{array}.$$

220. "**Contributions to the chemistry of the terpenes. Part VIII. Dihydrocamphene and dihydrobornylene.**" **By George Gerald Henderson and Ernest Ferguson Pollock.** (Trans., 1910, 1620).

When heated with hydrogen in presence of nickel according to the method of Sabatier and Senderens, bornylene, $C_{10}H_{16}$, is easily converted into *dihydrobornylene*, $C_{10}H_{18}$, which appears to be identical with the saturated hydrocarbon camphane. When camphene, $C_{10}H_{16}$, is hydrogenated in a similar manner, the reaction is not so complete, and the nature of the product depends on the temperature. At 120—180° a solid product, melting at about 64°, was obtained, which by fractional crystallisation from methyl alcohol was proved to be a mixture of dihydrocamphene, $C_{10}H_{18}$, already prepared by Vavon (*Compt. rend.*, 1909, **149**, 997), with a small proportion of unchanged camphene. At a higher temperature a liquid was produced, which was also found to be a mixture, containing dihydrocamphene, a little unchanged camphene, and a small proportion of a third substance which was not further investigated. Dihydrocamphene, unlike dihydrobornylene, differs widely from camphane in melting point and other physical properties.

These results confirm the view that the arrangement of the carbon atoms in the molecule of bornylene is the same as in that of camphane, and that the structure of the molecule of camphene is of a different type.

221. "The oxidation of monohydric phenols with hydrogen peroxide." By George Gerald Henderson and Robert Boyd.

(Trans., 1910, 1659).

A 30 per cent. aqueous solution of hydrogen peroxide has been found to be a good oxidising agent for monohydric phenols of the benzene series, the products being either a dihydric phenol, or a quinone, or even in some cases a tetrahydric phenol. From the results obtained with a number of phenols, it appears that those monohydric phenols in which the para-position relative to the hydroxyl group is unoccupied are most easily attacked by the oxidising agent, and yield as the main product either a *p*-dihydric phenol or a quinone according to the conditions of the experiment. On the other hand, those monohydric phenols in which the para-position relative to the hydroxyl group is occupied are not so easily oxidised, and usually yield dihydric phenols in which the hydroxyl groups are in the ortho-position to each other. Several new compounds were obtained.

Some experiments on the action of hydrogen peroxide on cyclic hydrocarbons were also made. The hydrocarbons of the benzene series which were examined appeared to be somewhat indifferent to the action of the oxidising agent, but naphthalene, anthracene, and phenanthrene were readily attacked, yielding phthalic acid, anthraquinone, and phenanthraquinone respectively.

222. "Solubilities of organic substances in organic solvents, a contribution to the theory of solubility." By Dan Tyrer. (Trans., 1910, 1778).

The solubility of a substance in a particular solvent is governed by two factors, namely, (1) the temperature, and (2) the concentration of the solvent, or the amount of solvent in unit volume of the saturated solution. Expressed mathematically, the solubility of a solute in a particular solvent under all possible conditions is given by the equation $S=K.f(C).\phi(T)$, where S is the solubility, C the concentration of the solvent, T the temperature, and K a constant. The object of the work was to determine the form of the function $f(C)$.

In order to avoid complications arising from the existence or formation of associated molecules in the solutions, the solubility of organic substances in organic solvents was studied. These were chosen also so as not to contain hydroxyl, amino- or cyanogen groups in order to minimise the possible formation of associated molecules. The method of attacking the problem was to find a solute soluble in a solvent A and insoluble in another solvent B, which is miscible with A in all proportions. The solubility of the solute in the mixed solvent is then determined, and the results are plotted against the concentration of the solvent in the saturated solution. Whilst some of the cases investigated give results which approximately represent the solubility at constant temperature as a linear function of the solvent concentration, the general conclusion deduced from the results is that no simple and common law governs the relation between the solubility and the concentration of the solvent.

Incidentally, determinations of the solubility of some organic substances in organic solvents were made at varying temperatures, and also of the concentrations of the solvents in the saturated solutions. It was noticed that in all the cases investigated the concentration of the solvent could be very approximately represented as a linear function of the temperature.

223. "The chlorination of toluene." By Julius Berend Cohen, Harry Medforth Dawson, John Reginald Blockey, and Arnold Woodmansey. (Trans., 1910, 1623).

Experiments have been made to determine the influence of various factors on the relative proportions of benzyl chloride and of *o*- and *p*-chlorotoluenes, which are obtained in the chlorination of toluene. The results indicate that side-chain substitution is favoured by light and by rise of temperature, whereas nuclear substitution is favoured by the presence of small quantities of water and by adding to the toluene substances like nitrobenzene, which tend to promote the formation of polyhalogen compounds. Electrolytic chlorine behaves practically the same as ordinary chlorine.

In respect of the above-mentioned factors, the chlorination process appears to be influenced in the same way as the bromination process, and the view is adopted that side-chain substitution is effected by halogen molecules, whereas nuclear substitution is brought about by halogen which is combined with the halogen acid in the form of polyhalogen compounds. This theory has already been put forward by Holleman (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, **8**, 512; *Rec. trav. chim.*, 1908, **27**, 435) to account for observations relating to the action of bromine on toluene.

A method for the analysis of mixtures of toluene, benzyl chloride, *o*-chlorotoluene, and *p*-chlorotoluene is described.

224. "The constitution of the benzenetetracarboxylic acids." By Hannah Bamford and John Lionel Simonsen. (Trans., 1910, 1904.)

A synthesis of Baeyer's mellophanic acid from 1 : 4-dimethylnaphthalene is described, and proof is adduced that the usual views on the constitution of mellophanic and prehnitic acids are incorrect. Prehnitic acid is 1 : 2 : 3 : 5-benzenetetracarboxylic acid, whilst mellophanic acid is the corresponding 1 : 2 : 3 : 4-compound.

225. "Action of light on the stereoisomeric piperonylideneacetones and on other unsaturated ketones." By Hans Stobbe and Forsyth James Wilson. (Trans., 1910, 1722.)

The authors have recently shown (*Annalen*, 1910, **374**, 237) that stereoisomeric ketones of the benzylidenedeoxybenzoin type, $Ar{\cdot}CH{:}CPh{\cdot}COPh$, can be converted into one another by the action of heat, small quantities of hydrochloric acid, or by direct sunlight, a state of equilibrium resulting. The two stereoisomeric piperonylideneacetones, $CH_2{:}O_2{:}C_6H_3{\cdot}CH{:}CH{\cdot}CO{\cdot}CH_3$ (Haber, *Ber.*, 1891, **24**, 618), have been investigated along similar lines, and similar results obtained.

It was next attempted to obtain the hitherto unknown stereoisomerides of anisylideneacetone, piperonylideneacetophenone, anisylideneacetophenone, and *o*-methoxybenzylideneacetophenone, but the experiments were unsuccessful. *Phenyl o-methoxystyryl ketone*, $MeO{\cdot}C_6H_4{\cdot}CH{:}CH{\cdot}COPh$, was obtained by condensing *o*-methoxybenzaldehyde and acetophenone by means of sodium hydroxide in alcoholic solution.

Doubly unsaturated ketones of the type of cinnamylideneacetophenone, CHPh⁚CH·CH⁚CH·COPh, are, by the action of sunlight, converted not only into stereoisomerides but also into polymerides.

226. "*cyclo***Hexane, its separation from, and its estimation in, mixtures containing benzene." By Thomas Stewart Patterson and Alexander Fleck.** (Trans., 1910, 1773.)

A mixture of *cyclo*hexane and benzene may be separated by shaking with a small amount of ethyl tartrate, when the mixture separates into two layers. When a larger quantity of ethyl tartrate is added to the mixture a homogeneous solution results, and from the rotatory power of this the composition of the mixture can be determined by comparing the found rotatory power with that of mixtures of known composition.

227. "The vapour pressures and molecular volumes of the mercuric halides and the relations between atomic volumes of elements before and after combination." By Edmund Brydges Rudhall Prideaux.

The vapour pressures of the liquid compounds from their melting points to their boiling points have been determined. The temperatures of equal vapour pressures were compared with those of fluorobenzene by Ramsay and Young's method. If in the equation:

$$\frac{T'_A}{T'_B} = \frac{T_A}{T_B} + c(T'_B - T_B),$$

T_B and T'_B are the temperatures of fluorobenzene, $c(HgCl_2) = 0{\cdot}0005$, $c(HgBr_2) = 0{\cdot}00037$, and $c(HgI_2) = 0{\cdot}00025$. Trouton's constant for the boiling point under 760 mm. pressure was found to be:

$HgCl_2$, 24·1; $HgBr_2$, 23·9; HgI_2, 23·7.

The specific volumes of the liquids were measured in silica dilatometers—the expansion being represented by the following, where D_t = density at t°.

$HgCl_2$ (280—335°); $D_t = 4{\cdot}400 - 0{\cdot}002218\,(t - 280°)$.
$HgBr_2$ (240—340°); $D_t = 5{\cdot}116 - 0{\cdot}00338\,(t - 240°)$.
HgI_2 (255—355°); $D_t = 5{\cdot}238 - 0{\cdot}00322\,(t - 255°)$.

The ratios between the molecular volumes of the liquid compounds and the sums of the atomic volumes of the liquid elements, all measured at equal pressures of saturated vapour, are constant over the range of pressures investigated. These ratios are probably much the same as the ratios of the volumes of the atoms before and after combination. There is a slight expansion on combination which, stated as the percentage increase on the volumes of the elements, is equal to:

For $HgCl_2$, 1·8; $HgBr_2$, 7·4; HgI_2, 9·5.

The numerical values of Trouton's constant and the expansions of the liquids show a slight association, diminishing in the order: chloride ⟶ bromide ⟶ iodide.

228. "A study of some unsaturated compounds containing the *tert.*-butyryl group. Part I." By Alfred Archibald Boon and Forsyth James Wilson. (Trans., 1910, 1751.)

The authors have investigated the action of bromine on *piperonylidenepinacoline*, $CH_2{:}O_2{:}C_6H_3{\cdot}CH{:}CH{\cdot}CO{\cdot}CMe_3$. This compound melts at 94—95°, and was obtained by the condensation of piperonal with pinacoline by means of sodium hydroxide. It gives an *oxime* (m. p. 144—145°), and, in chloroform solution, yields a *monobromide* (m. p. 110—111°), $CH_2{:}O_2{:}C_6H_3{\cdot}CH{:}CBr{\cdot}CO{\cdot}CMe_3$ (α-compound), or $CH_2{:}O_2{:}C_6H_3{\cdot}CBr{:}CH{\cdot}CO{\cdot}CMe_3$ (β-compound), and also a *dibromide*, $CH_2{:}O_2{:}C_6H_3{\cdot}CHBr{\cdot}CHBr{\cdot}CO{\cdot}CMe_3$, which melts at 138—139°, and is the chief product of the reaction.

When absolute alcohol was allowed to act on the latter, a substance was obtained identical with that produced when the dibromide, in alcoholic solution, was treated with potassium hydroxide (1 mol.). This product, which melts at 82—83°, may be represented either as $CH_2{:}O_2{:}C_6H_3{\cdot}CHBr{\cdot}CH(OEt){\cdot}CO{\cdot}CMe_3$ (α) or $CH_2{:}O_2{:}C_6H_3{\cdot}CH(OEt){\cdot}CHBr{\cdot}CO{\cdot}CMe_3$ (β).

As a result of the action of potassium hydroxide (2 mols.) on the dibromide (m. p. 138—139°) in alcoholic solution, the authors obtained a compound identical with that already referred to, melting at 82—83°, and two ethoxy-derivatives of piperonylidenepinacoline, $CH_2{:}O_2{:}C_6H_3{\cdot}CH{:}C(OEt){\cdot}CO{\cdot}CMe_3$ (α) and $CH_2{:}O_2{:}C_6H_3{\cdot}C(OEt){:}CH{\cdot}CO{\cdot}CMe_3$ (β), melting at 86—87° and 112—113° respectively. These compounds may, however, be stereoisomeric.

229. "A new method for the preparation of aryl ethers of glycerol α-monochlorohydrin." By David Runciman Boyd and Ernest Robert Marle. (Trans., 1910, 1788.)

The aryl ethers of glycerol α-monochlorohydrin are conveniently prepared by leaving a mixture of the phenol, epichlorohydrin, and a small quantity of sodium hydroxide for some days at the ordinary temperature. *γ-Chloro-β-hydroxy-α-o-tolyloxypropane* (b. p. 166°/18 mm.) and the corresponding *p*-tolyl compound (b. p. 165°/

14 mm.) have been prepared. The phenylurethane of *γ-chloro-β-hydroxy-α-phenoxypropane* melts at 70°, and the phenylurethanes of the o-*tolyloxy-* and p-*tolyloxy*-compounds at 80—81° and 113—114° respectively.

230. "The action of ammonia on the glycide aryl ethers. Part II. Phenoxypropanolamines." By David Runciman Boyd. (Trans., 1910, 1791.)

The constitution previously assigned to the primary base derived from *o*-tolyl glycide ether, $C_7H_7\cdot O\cdot CH_2\cdot CH(OH)\cdot CH_2\cdot NH_2$, has been confirmed by the preparation of the same substance from γ-chloro-β-hydroxy-α-*o*-tolyloxypropane and ammonia.

Phenyl glycide ether, when treated with a solution of ammonia in 50 per cent. alcohol, gives a primary *base*, $C_6H_5\cdot O\cdot CH_2\cdot CH(OH)\cdot CH_2\cdot NH_2$ (m. p. 97—98°), and a secondary *base*, $[C_6H_5\cdot O\cdot CH_2\cdot CH(OH)\cdot CH_2]_2NH$ (m. p. 101—102°).

231. "The relation of position isomerism to optical activity. Part VIII. The rotation of the menthyl esters of the alkyloxy- and alkylamino-derivatives of benzoic acid." By Julius Berend Cohen and Harold Ward Dudley. (Trans., 1910, 1732.)

The present investigation is a continuation of former studies on the same subject, and deals with substituted menthyl benzoates containing positive in place of negative groups. Ten series of isomeric esters have been prepared, and their rotational values ascertained. The authors find that temperature is an important factor in such determinations. Whilst the temperature-coefficient for the ortho-compounds is small and in nearly all cases positive, that of the para-compounds is large and negative, the intermediate meta-compounds being small and also negative. It follows that if a comparison of the three isomerides is made at 100° instead of 20°, the rotational values of the meta- and para-isomerides approximate to that of the unsubstituted menthyl benzoate at the same temperature, whereas the value of the ortho-compound is widely divergent. The general rule which was previously established in the case of the halogen, nitro- and nitro-halogen derivatives applies with equal truth to the menthyl esters containing positive groups, namely, *the ortho-substituent exerts a preponderating effect on the rotational value of the active group.*

232. "The volatile constituents of coal." By Maurice John Burgess and Richard Vernon Wheeler. (Trans., 1910, 1917.)

It is shown that with all coals, whether bituminous, semi-bituminous, or anthracitic, there is a well-defined decomposition-point at a temperature lying between 700° and 800°, which corresponds with a marked increase in the quantity of hydrogen evolved. With bituminous coals, the increase in the quantity of hydrogen evolved falls off at temperatures above 900°, but with anthracitic coals it is maintained up to 1100°.

It is further shown that ethane, propane, and butane, and, probably, higher members of the paraffin series of hydrocarbons, form a large percentage of the gases evolved at low temperatures, but that at temperatures above 700° the evolution of such hydrocarbons practically ceases.

The suggestion is advanced that coal of whatever geological age contains a compound which undergoes decomposition at temperatures above 700° (under the atmospheric pressure), and yields hydrogen as its principal gaseous product. It seems probable, also, that the same compound is responsible for the hydrocarbons of the paraffin series that make their appearance at low temperatures.

233. "Tetramethyl ferrocyanide and some derivatives." By Ernald George Justinian Hartley. (Trans., 1910, 1725.)

Experiments have been made in continuation of the work recently published (*Trans.*, 1910, **97**, 1066) on the reaction between potassium ferrocyanide and methyl sulphate.

By taking care to exclude moisture as far as possible, the reaction followed a somewhat different course, and a neutral *methyl sulphate*, $(CH_3)_6FeC_6N_6(CH_3\cdot SO_4)_2$, was isolated of the same base, the acid salts of which had been previously obtained. Unlike the acid methyl sulphate, this salt does not undergo any change on keeping in a vacuum over sulphuric acid. In addition to this, there were formed some of the acid sulphate previously described and another neutral salt of the same base, probably the ethyl sulphate. The neutral sulphate, $(CH_3)_6FeC_6N_6SO_4$, can be prepared from the acid sulphate by neutralising with barium hydroxide in aqueous solution, removing barium sulphate, and evaporating the filtrate in a vacuum. It is an unstable substance, differing from the acid salt in being soluble in ethyl alcohol. The corresponding chloride is prepared by neutralising with barium hydroxide as above, and then adding excess of barium chloride and evaporating to dryness. The salt is extracted from the excess of barium chloride with alcohol and precipitated with ether. It is far more stable than the sulphate.

On heating the chloride under diminished pressure to 140°, methyl chloride is given off quantitatively, and almost pure tetramethyl ferrocyanide is left. This resembles the corresponding ethyl compound prepared from silver ferrocyanide and ethyl iodide in being soluble in chloroform and water, and giving in aqueous solution a white precipitate with mercuric chloride and a reddish-purple coloration with ferric chloride. It is deposited from chloroform in well-formed crystals containing chloroform of crystallisation.

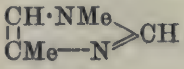
234. "The molecular complexity of amides in various solvents. Part II." By Andrew Norman Meldrum and William Ernest Stephen Turner. (Trans., 1910, 1605.)

In continuation of their previous work (*Trans.*, 1908, **93**, 876) the authors have determined the molecular complexity of seventeen additional amides in the same organic solvents as before. The principal object of the work was to test the Nernst-Thomson hypothesis, that association of the solute tends to be high when the dielectric constant of the solvent is low, and vice versa. They regard their results as in good agreement with the hypothesis. The following table summarises the results (for organic solvents) of both investigations, and includes the dielectric constants of the solvents:

Solvent.	Alcohol.	Acetone.	Chloroform.	Ether.	Benzene.
No. of amides investigated	28	27	22	14	21
No. of amides which form simple molecules	24	20	3 and 1 doubtful	3 and 2 doubtful	3 and 1 doubtful.
No. of amides which form associated molecules	1 and 3 doubtful	4 and 3 doubtful	18	9	17
Dielectric constant	25·4 at 18·5°	21·2 at 22°	5 at 22°	4·4 at 18°	2·3 at 18°

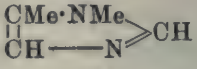
235. "The tautomerism of glyoxalines and the constitution of pilocarpine." By Frank Lee Pyman. (Trans., 1910, 1814.)

Otto Fischer (*J. pr. Chem.*, 1906, [ii], **73**, 419; 1907, [ii], **75**, 88) has already shown that benziminazoles are tautomeric, and Jänecke (*Ber.*, 1899, **32**, 1098) and Gabriel (*Ber.*, 1908, **41**, 1926) have made it seem probable that simple glyoxalines behave similarly. Conclusive evidence that simple glyoxalines react as tautomeric compounds is now brought forward, for it is found that 4(or 5)-methylglyoxaline yields on methylation a mixture of the two isomerides, 1 : 4-*dimethylglyoxaline* (I) (b. p. 198—199°) and 1 : 5-*dimethylglyoxaline* (II) (b. p. 224—225°):



$$\left.\begin{array}{l}\mathrm{CH\cdot NMe}\\ \|\\ \mathrm{CMe{-}{-}N}\end{array}\right\rangle\mathrm{CH}$$

(I.)



$$\left.\begin{array}{l}\mathrm{CMe\cdot NMe}\\ \|\\ \mathrm{CH{-}{-}{-}N}\end{array}\right\rangle\mathrm{CH}$$

(II.)

Jowett and Potter (*Trans.*, 1903, **83**, 464) by the methylation of 4(or 5)-methylglyoxaline obtained a dimethylglyoxaline which they regarded as a simple substance, but which was not identical with the dimethylglyoxaline obtained by Jowett (*Trans.*, 1903, **83**, 438) from *iso*pilocarpine. It is now shown that the latter compound is identical with 1 : 5-dimethylglyoxaline, and that Jowett and Potter's dimethylglyoxaline was a mixture of the 1 : 4- and 1 : 5-isomerides, consisting mainly of the former.

The methylation of *bromo*-4(or 5)-*methylglyoxaline* and *dibromo*-4(or 5)-*methylglyoxaline* yields in each case a mixture of two isomeric N-*methyl* derivatives which have been separated and characterised. The bromination of 1 : 4- and 1 : 5-dimethylglyoxaline leads to the formation of one of the bromodimethylglyoxalines and one of the dibromodimethylglyoxalines in each case.

236. "Kinetics of the reaction between silver salts and aliphatic iodides." By Frederick George Donnan and Harold Edward Potts.

(Trans., 1910, 1882.)

The experiments of Burke and Donnan (*Trans.*, 1904, **85**, 555) have shown that the reaction between silver nitrate and an alkyl iodide in alcoholic solution is disturbed by an accelerating effect due to one of the products. In the present paper it is shown that in the reaction between silver lactate and ethyl iodide in aqueous alcohol, the accelerating effect disappears. It is also shown that in the reaction between silver nitrate and ethyl iodide in a non-hydroxylic solvent (acetonitrile) when no free (nitric) acid is produced, the kinetic behaviour does not essentially differ from that observed in alcoholic and aqueous solutions. The reaction between iodoform and silver nitrate in alcoholic solution follows the same pseudo-bimolecular equation as the reaction between a mono-iodide and silver nitrate. It was found that methylene iodide reacts very sluggishly with silver nitrate in alcoholic solution. Owing to the rapid decomposition of carbon tetraiodide in alcoholic solution, comparative experiments with this substance could not be carried out with sufficient accuracy. Although the matter could not be decisively settled, the general trend of the experimental evidence is in favour of the view that it is the undissociated silver salt which reacts with the alkyl iodide in the first instance, with the formation, possibly, of a transient intermediate product. The suggestion is made that the constancy of the velocity-coefficient in any particular reaction is due to a compensation of the decrease due to the increasing relative ionisation of the silver salt by the acceleration referred to above. Senter's suggestion that the acceleration is due to the silver halide produced is discussed.

237. "The identity of osyritrin, myrticolorin, violaquercitrin, and rutin." By Arthur George Perkin. (Trans., 1910, 1776.)

It has been shown (*Trans.*, 1902, **81**, 477) that osyritrin, myrticolorin, and violaquercitrin are identical. Schmidt (*Arch. Pharm.*, 1908, **246**, 214) and Wunderlich (*ibid.*, **246**, 224) have found that when hydrolysed violaquercitrin gives, in addition to quercetin and dextrose, also rhamnose, and that this glucoside is identical with rutin, which yields the same products. It therefore appeared certain that osyritrin and myrticolorin in reality consist of rutin, and this has been found to be the case.

238. "A glucoside from Tephrosia purpurea." By George Clark, jun., and Shrish Chandra Banerjee. (Trans., 1910, 1833.)

Tephrosia purpurea (Pers.), nat. ord. *leguminosae*, contains a yellow, crystalline glucoside (Clarke and Banerjee, *Proc.*, 1909, **25**, 16). This substance has been further investigated, and has the formula $C_{27}H_{30}O_{16},3H_2O$. When hydrolysed, it is decomposed into quercetin, dextrose, and rhamnose according to the equation $C_{27}H_{30}O_{16} + 3H_2O = C_{15}H_{10}O_7 + C_6H_{12}O_6 + C_6H_{12}O_5,H_2O$.

It is identical with rutin described by Schunk (*Trans.*, 1888, **53**, 264), which therefore has the above formula, and not that hitherto ascribed to it.

239. "The molecular complexity of amides in various solvents. Part III. Amides in aqueous solution." By Andrew Norman Meldrum and William Ernest Stephen Turner. (Trans., 1910, 1805.)

In continuation of their previous work (Trans., 1908, **93**, 876; 1910, **97**, 1605) the authors have determined the molecular complexity of fourteen additional amides in aqueous solution. Water, by reason of its high dielectric constant, should prevent association of the solute, according to the Nernst-Thomson rule. The authors find that fifteen out of the total of twenty-three amides examined are associated in water.

The authors hold that association in water is of frequent occurrence, and has been ignored in the study of aqueous solutions to an injurious extent. They find that during the hydrolysis of ethyl acetate, or the inversion of sucrose, by hydrochloric acid, the presence of methylacetanilide, an associated substance, has an effect similar to that caused by the presence of sodium chloride, as observed by Caldwell (*Proc. Roy. Soc.*, 1906, **78**, *A*, 272) and H. E. Armstrong (*loc. cit.*, 1907, **79**, *A*, 576). The accelerations due to equal weights of the two foreign substances are approximately the same.

240. "Optically active salts of 4-oximino*cyclo*hexanecarboxylic acid and the configuration of the oximino-group." By William Hobson Mills and Alice Mary Bain. (Trans., 1910, 1866.)

If morphine (1 mol.) is added to the ethyl-alcoholic solution of 4-oximino*cyclo*hexanecarboxylic acid, the morphine salt which separates contains a dextrorotatory form of the acid, for on decomposing it with excess of ammonia and removing the morphine, the solution of ammonium salt obtained is strongly dextrorotatory, the molecular rotation varying from $[M]_D$ 50° to $[M]_D$ 60° in different preparations. Similarly, from the quinine salt (*Proc.*, 1909, **25**, 178), which has been crystallised from water, the corresponding lævorotatory ammonium salt, $[M]_D$ $-70°$ to $-80°$, has been obtained. That the substances to which these optically active solutions of ammonium salt owe their rotatory power are the normal ammonium salts of dextro- and lævo-rotatory forms of 4-oximino*cyclo*hexanecarboxylic acid was shown by treating the solutions with silver nitrate. The substances thus precipitated were pure silver salts of this acid, and when treated with an aqueous solution of sodium chloride they gave respectively dextro- and lævo-rotatory solutions of the corresponding sodium salts, the molecular rotations observed being $[M]_D$ 74·5° and $-79·9°$. Autoracemisation takes place very rapidly in neutral solutions of these optically active salts, but it is greatly retarded by the presence of excess of alkali.

By these experiments the existence of a new type of optically active substances is demonstrated, the molecular asymmetry of which is determined by the peculiar configuration of the doubly linked tervalent nitrogen atom. In addition, direct proof is afforded that in the oximino-group the three valencies of the nitrogen atom are directed along the three edges of a trihedral angle, as was postulated by Hantzsch and Werner (*Ber.*, 1890, **23**, 11).

241. "**The resolution of benzoyloscine.**" **By Frank Tutin.**

(Trans., 1910, 1793.)

Benzoyloscine (benzoylscopoline) has been resolved by the fractional crystallisation of its d-*bromocamphorsulphonate*. *Benzoyl*-d-*oscine* d-*bromocamphorsulphonate* forms needles, which melt at 246°, but *benzoyl*-l-*oscine* d-*bromocamphorsulphonate* could not be obtained in a state of purity. *Benzoyl*-d-*oscine hydrochloride* melts at 283—284°; the corresponding *nitrate* at 200°; the *picrate* at 211—212°; and the *aurichloride* at 189—190°.

Benzoyl-d-*oscine* has $[\alpha]_D$ +3·5° in 50 per cent. alcohol, whilst the ion of this base has $[\alpha]_D$ +10·0°, calculated from the rotation of its *d*-bromocamphorsulphonate.

d-*Oscine* was prepared in the form of its *hydrochloride* by hydrolysing benzoyl-*d*-oscine with hydrochloric acid. It has a specific rotation of about +77·7°.

Benzoyloscine d-*camphorsulphonate* melts at 167—168°, and forms microscopic, diamond-shaped crystals, but it could not be resolved by fractional crystallisation.

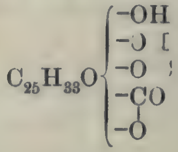
242. "**Carboxylic acids of** *cyclo***hexanone and some of its derivatives.**" **By Henry Dent Gardner, William Henry Perkin, jun., and Hubert Watson.** (Trans., 1910, 1756.)

A detailed account of an investigation of which a preliminary note has already appeared (this vol., p. 136).

243. "**Note on the constitution of α-elaterin.**" **By Charles Watson Moore.** (Trans., 1910, 1797.)

The following formulæ have, at various times, been suggested for elaterin: $C_{20}H_{28}O_5$ (Zwenger); $C_{22}H_{30}O_6$ (Thoms); $C_{24}H_{34}O_6$ (Hemmelmayr); and $C_{28}H_{38}O_7$ (Berg). The present author has now obtained results which prove the correctness of the empirical formula suggested by Berg. The presence of an acetyl group in elaterin has been confirmed, but it has been shown that this substance contains no ketonic or aldehydic group. Two crystalline substances have been obtained by the oxidation of "elateric acid," which have been shown to possess the formulæ $C_{24}H_{32}O_4$ and $C_{24}H_{30}O_5$ respectively. The latter of these is a diketone, and has been designated *elaterone*. On distillation with zinc dust, elaterin yields 1 : 4-dimethylnaphthalene.

The results so far obtained indicate that the formula of elaterin may be represented as follows:



$$C_{25}H_{33}O\begin{cases}-OH\\ -O\\ -O\\ -CO\\ -O\end{cases}$$

244. "The viscosity of salt solutions."

By Malcolm Percival Applebey. (Trans., 1910, 2000.)

By the use of specially standardised viscometers of a modified Ostwald type, the viscosities of aqueous solutions of lithium nitrate have been determined at 25°, 18°, and 0° over wide ranges of concentration with an error of not more than 0·01 per cent. for solutions less concentrated than normal.

The formula of Grüneisen (*Wiss. Abh. Phys.-Tech. Reichs.*, 1905, **4**, 151) is found not to represent the phenomena of dilute solution. A method of calculating the viscosity of salt solutions from their hydration numbers, or vice versa, has been described. The application of this method to the viscosities of solutions of lithium nitrate at 18° and 25° gives results consistent with the estimates of ionic hydration made by other observers. The application of the method to some other salts is discussed.

245. "Some reactions of keten. Combination with hydrocyanic acid."

By Stella Deakin and Norman Thomas Mortimer Wilsmore. (Trans., 1910, 1968.)

The compound which was mentioned (*Proc.*, 1908, **24**, 77) as being formed by the action of keten on hydrocyanic acid has been further investigated. In a pure state it is a colourless liquid, which boils undecomposed at 110·2°(corr.)/100 mm., and with slight decomposition at 173°/772 mm. It may be frozen to a white solid, which melts at −196° to −195°. Analysis and determination of molecular weight show that it has the composition $C_5H_5O_2N$. The new substance is decomposed by water with formation of acetic and hydrocyanic acids, and by alcohol in the presence of mineral acids, ethyl acetate and hydrocyanic acid being obtained. It also reacts with aniline, giving acetanilide and hydrocyanic acid. It is tentatively suggested that the new compound may be *a-acetoxy-acrylonitrile*, $CH_2{:}C(CN){\cdot}O{\cdot}CO{\cdot}CH_3$, a constitution which is shown to be consistent with the molecular volume, refractivity, and dispersion of the substance.

The actions of magnesium methyl iodide and of nitrosyl chloride on keten have also been studied. With the former acetone is produced, and with the latter chloroacetyl chloride; but in both cases the greater part of the keten condenses with the formation of brown resins.

246. "The polymerisation of keten. *cyclo*Butan-1:3-dione ('acetylketen')." By Frances Chick and Norman Thomas Mortimer Wilsmore. (Trans., 1910, 1978.)

The research on the polymerisation of keten (*Trans.*, 1908, **93**, 946) has been continued, and the first or bimolecular polymeride has been more fully studied. This substance combines with bromine to form a bromoacetoacetyl bromide, which with alcohol gives γ-bromoacetoacetic ester and not the α-derivative, showing conclusively that the bimolecular polymeride is *cyclo*butan-1:3-dione and not acetylketen, as previously supposed. From the bromoacetoacetyl bromide, an anilide was also obtained, identical with the bromoacetoacetanilide described by Knorr (*Annalen*, 1886, **236**, 79), which shows that the bromine in this substance is in the γ- and not in the α-position, as believed by him. As a further consequence, the bromohydroxymethylquinoline, obtained by Knorr by the action of sulphuric acid on bromoacetoacetanilide, would seem to have the bromine attached to the methyl group and not to the nucleus, or else the bromine atom must wander from the methyl to the CH_2 group during the condensation. With ammonia, *cyclo*butan-1:3-dione forms, in the first place, the acetoacetamide described by Claisen and Meyer (*Ber.*, 1902, **35**, 583); but by the further action of ammonia an oil is obtained, which appears to consist chiefly of aminocrotonamide, since on heating it gives a compound having the composition $C_8H_{13}O_2N_3$, which is in all probability a lutidine derivative, namely, 4-*amino*-2:4-*dimethyl*-Δ^2-*tetrahydro*-6-*pyridone*-3-*carboxylamide.* With semicarbazide, *cyclo*butan-1:3-dione forms the semicarbazone-semicarbazide of acetoacetic acid. With magnesium methyl iodide, diacetone alcohol appears to be formed in small quantity. With hydrogen in presence of platinum black, *cyclo*butan-1:3-dione is reduced to butyraldehyde. It does not react with sodium, with phenylcarbimide, or with hydrocyanic acid. On long keeping, or on warming, it polymerises with formation of dehydracetic acid.

Much work has been done with a view to elucidating the nature of the yellow, crystalline compound, which is formed from *cyclo*butan-1:3-dione in the presence of quinoline; but so far no clue to its constitution has been found. Its empirical formula is, however, $C_{13}H_{10}O_3$. It is possibly a naphthalene derivative.

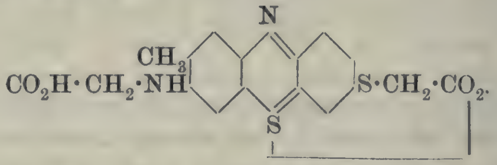
247. "Aromatic antimony compounds. Part I. The oxidation and nitration of triphenylstibine." By Percy May. (Trans., 1910, 1956.)

A description is given of the nitration of triphenylstibine, a preliminary account of which has already appeared (this vol., p. 142). The behaviour of triphenylstibine towards various oxidising agents, such as concentrated sulphuric acid, and potassium permanganate, is described, and the relation between various derivatives of triphenylstibine oxide, and the influence of the nitro-group in the molecule are also discussed.

248. "Contributions to our knowledge of the sulphide dyestuffs. Part I." By George Herbert Frank.

It has been found that many colouring matters belonging to the "sulphide" class readily combine with chloroacetic acid, giving carboxylic derivatives which are readily soluble in alkalis.

The colouring matter known as immedial-indone gives a dicarboxylic derivative, $C_{17}H_{14}O_4N_2S_2$ (Found, M.W. = 377), which requires, for its reduction to the leuco-compound, two atoms of hydrogen per molecule. The suggested constitution for this dicarboxylic derivative is:



249. "The constituents of leptandra." By Frederick Belding Power and Harold Rogerson. (Trans., 1910, 1944.)

The material employed for this investigation was commercial "leptandra," consisting of the dried rhizome and roots of *Veronica virginica*, Linné (*Leptandra virginica*, Nuttall).

A concentrated alcoholic extract of this material, when distilled in a current of steam, yielded a small amount of an essential oil. The latter was a dark-coloured liquid, which distilled between 120° and 160°/25 mm.

The portion of the extract which was soluble in water contained 3:4-dimethoxycinnamic acid, $C_6H_3(OMe)_2\cdot CH\colon CH\cdot CO_2H$ (m. p. 180—181°); a quantity of mannitol, amounting to 2·14 per cent. of the weight of the drug; and a sugar which yielded *d*-phenylglucosazone (m. p. 209—211°), together with tannic and colouring matter. It yielded, furthermore, a quantity of an amorphous product, which possessed an intensely bitter, nauseous taste, and amounted to 1·6 per cent. of the weight of the drug. By the hydrolysis of this product there were obtained, besides resinous material, cinnamic and *p*-methoxycinnamic acids.

The portion of the extract which was insoluble in water consisted chiefly of a dark brown resin, which amounted to 6·2 per cent. of the weight of the drug. From this resin the following substances were obtained: a phytosterol, $C_{27}H_{46}O$ (m. p. 135—136°; $[\alpha]_D$ $-33·0°$), the acetate of which melts at 119—120°, and which it is proposed to designate *verosterol*; a mixture of fatty acids, consisting apparently of oleic, linolic, palmitic, and stearic acids; *p*-methoxycinnamic acid, $OMe·C_6H_4·CH\dot{:}CH·CO_2H$ (m. p. 170°), which was present in the form of an ester, and a very small amount of 3 : 4-dimethoxycinnamic acid.

It has not been possible to confirm the statement recorded in the literature that "leptandra" contains a crystalline, bitter glucoside, designated as "leptandrin," to which its activity may be attributed, nor does it contain a saponin, as has been asserted.

250. "The formation of tolane derivatives from *p*-chlorotoluene and 3 : 4-dichlorotoluene." By James Kenner and Ernest Witham.

(Trans., 1910, 1960.)

The anomalous formation of a tolane derivative during the preparation of benzotrichloride from toluene, described by Liebermann and Homeyer (*Ber.*, 1879, **12**, 1971), was also observed by Armstrong and Wynne during the conversion of *p*-chlorotoluene and of 3 : 4-dichlorotoluene into the corresponding chlorobenzylidene dichlorides. The present authors have investigated these toluene derivatives with the view of determining the conditions leading to their formation.

To aid in the study of this condensation, 4 : 4′-dichlorotolane tetrachloride has been obtained by the action of copper powder on *p*-chlorobenzotrichloride. The method gives only moderate yields, and, as previously found by Fox (*Ber.*, 1893, **26**, 653), and now confirmed by the authors, breaks down when applied to the case of *o*-chlorobenzotrichloride.

cis- and *trans*-4 : 4′-Dichlorotolane dichlorides, melting at 166—167° and 86—87° respectively, result from the action of zinc dust on the tetrachloride in alcoholic solution at 50° for two days, although under these conditions some of the *cis*-isomeride is further reduced to 4 : 4′-dichlorotolane (m. p. 175—176°), whilst at the boiling point the conversion is complete. Both the *cis*-2 : 2′- and 4 : 4′-dichlorotolane dichlorides under similar conditions give the corresponding dichlorotolanes.

251. "The effect of temperature on the equilibrium $2CO \rightleftharpoons CO_2 + C$." By Thomas Fred Eric Rhead and Richard Vernon Wheeler.

The equilibrium between carbon monoxide, carbon dioxide, and carbon has been determined for every 50° between 850° and 1100° and for 1200°.

The method adopted has been to circulate carbon dioxide continuously over purified wood charcoal heated in an electric resistance furnace of special construction until the pressure in the apparatus attained a constant value.

The values obtained for the equilibrium are as follow:

Temperature.	Carbon dioxide. Per cent. by volume.	Carbon monoxide. Per cent. by volume.
850°	6·23	93·77
900	2·22	97·78
950	1·32	98·68
1000	0·59	99·41
1050	0·37	99·63
1100	0·15	99·85
1200	0·06	99·94

From the equation

$$\frac{19,500}{T} + \log_e \frac{c_1^2}{c_2} = k$$

(derived from Le Chatelier's general equation for equilibrium in gaseous systems), the following values for k are obtained:

T.	k.
1123	20·01
1173	20·39
1223	20·24
1273	20·44
1323	20·32
1373	20·70
1473	20·65

252. "The molecular complexity in the liquid state of tervalent nitrogen compounds." By William Ernest Stephen Turner and Ernest Wyndham Merry.

The molecular complexities of nearly forty organic nitrogen compounds, comprising amines, nitrosoamines, nitriles, and amides have been determined by Ramsay and Shields' method; one, and the main, object of the investigation being to ascertain if the molecular association in the amides can be ascribed to the action of the unsaturated valencies of the nitrogen or oxygen atom present in the amido-group.

Primary amines were found to be slightly associated. Secondary and tertiary amines gave abnormally high values of the Ramsay and Shields' constant, and the results raised the question of the validity of the Ramsay and Shields' formula.

The aliphatic nitrosoamines and aliphatic nitriles are associated;

the aromatic members of these two groups of compounds are either only slightly or non-associated.

The amides and anilides examined are associated, the extent of association being of the same order as found in the aliphatic alcohols and acids. The aromatic amides, benzamide and salicylamide, are strongly associated. Below 80°, formamide is more highly associated than water, but the molecular complexity decreases rapidly with rise of temperature.

It was concluded that the cause of molecular association in the amides cannot be directly ascribed to the unsaturated character of the nitrogen or oxygen atom, and that association only occurs when these elements are found in combination in electronegative groups.

Thursday, October 20th, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. H. A. Tempany and J. Haycock were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Malcolm Percival Applebey, Hill View, Foxcombe, near Oxford.
Manindranath Banerjee, 3, Padmanath Lane, Shambazar, Calcutta.
Fred Wilkinson Barwick, Rathlyn, Kilmorey Gardens, St. Margaret's-on-Thames.
Sarat Chandra Bhattacharya, M.A., Hazaribagh, Bengal, India.
André Bracher, 30, Guilford Street, W.C.
Frederick Hugh Rochfort Brady, 12, Park View Avenue, Harold's Cross, Dublin.
Stewart McGregor Bosworth, B.Sc., 65, Abingdon Villas, Kensington, W.
John C. Briggs, East View, Workington.
John Brown, B.Sc., Technical Institute, Timaru, New Zealand.
Frederick Challenger, B.Sc., 324, Mansfield Road, Carrington, Nottingham.
Reginald Thomas Colgate, 26, Birdhurst Rise, S. Croydon.
Thomas Watts Coslett, Steel Road, Northfield, Worcs.
John Hughes Davies, B.Sc., Ph.D., St. Peter's College, Peterboro'.
James Hugh Duncan, 18, Park Place, Cardiff.
William Gidley Emmett, B.A., Caius College, Cambridge.
Ainslie Jackson Ensor, B.Sc., 67, Cannon Street, Wellingborough.
John George Finlayson, B.A., 13, Monarch Terrace, Blaydon-on-Tyne.
George Alexander Godden, 18, Rylett Crescent, Shepherd's Bush.
Edmund Knecht, M.Sc., Ph.D., Municipal School of Technology, Manchester.

William Arthur Knight, M.A., 5, The Green, Marlborough.
Bertram Lambert, M.A., 34, Leckford Road, Oxford.
Kenneth Stewart Low, 3, Luxemburg Gardens, W.
Clement Ward Lowe, Thorneyholme, Knutsford.
Malcolm McNish, Shortsands, St. Neots.
James Irvine Orme Masson, M.Sc., 2, Chester Street, Edinburgh.
Riko Majima, 37, Linden Gardens, Notting Hill Gate, W.
Thomas R. Merton, B.Sc., 18, Grosvenor Street, W.
Dhirendranath Mitra, B.A., 89/2, Musjeed Bari Street, Calcutta.
Harold Moore, B.Sc., 84, Kalashnikeff Quay, St. Petersburg.
Valliyil Govindan Nair, B.A., B.Sc., 223, Upper Brook Street, C-on-M., Manchester.
John Hamilton Paterson, M.Sc., Carmyle, Wellington Street, Grimsby.
Alfred John Pennington, Oakley, Fallowfield, Manchester.
Benjamin Ashwell Posford, Wood Dene, Kippington, Sevenoaks.
Hari Prasad, B.A., B.Sc., 97, Roseneath Road, Urmston, Manchester.
Frederick Valentine Ramsden, Alexandra Street, E. St. Kilda, Victoria, N.S.W.
Thomas John Rees, B.A., B.Sc., Cwmllynfell, Swansea Valley.
Gangaram Rajendrarao Rele, 18, Entwistle Street, Manchester.
Joseph Ridgway, B.A., Rownall Hall, Wetley Rocks, Stoke-on-Trent.
James Beglar Robinson, Dairy School, Kilmarnock.
Frederick Herbert Sharpe, The Ferns, Cressington Park, Liverpool.
Percy Lancelot James Smith, M.A., Army College, Storrington, Sussex.
Jwala Prasad Srivastava, B.Sc.Tech., 20, Curzon Avenue, Victoria Park, Manchester.
Augustus George Terrey, 47, Cann Hall Road, Leytonstone, N.E.
Joseph Turner, Azo House, Birkby, Huddersfield.
Robert Lauder Mackenzie Wallis, B.A., Llwyndu, Cardiff Road, Llanishen, S. Wales.
Syed Muhammad Jusuf, B.Sc.Tech., Municipal School of Technology, Manchester.

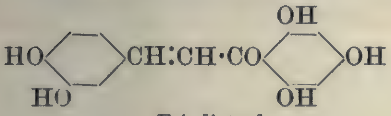
Of the following papers, those marked * were read:

*253. "The constitution of eriodictyol, of homoeriodictyol, and of hesperitin." By Frank Tutin.

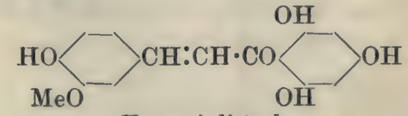
The author has methylated eriodictyol, homoeriodictyol, and hesperitin, and obtained from each of these compounds 2-hydroxy-

4 : 6-dimethoxyphenyl 3 : 4-dimethoxystyryl ketone (m. p. 154°) and 2 : 4 : 6-*trimethoxyphenyl* 3 : 4-*dimethoxystyryl ketone* (m. p. 85° when air-dried, 117·5° when anhydrous), thus proving the correctness of the conclusions of Power and Tutin (*Trans.*, 1907, **91**, 887) regarding the constitution of the three naturally-occurring substances mentioned.

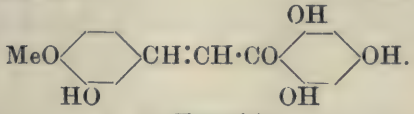
These compounds are therefore represented as follows:



Eriodictyol.



Homoeriodictyol.



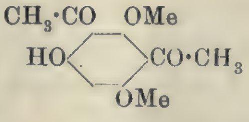
Hesperitin.

The view was expressed that naringenin is not the phloroglucinyl ester of *p*-hydroxycinnamic acid, as concluded by Will (*Ber.*, 1887, **20**, 297), but 2 : 4 : 6-*trihydroxyphenyl* 4-*hydroxystyryl ketone*.

*254. "The synthesis of 2 : 4 : 6-trimethoxyphenyl 3 : 4-dimethoxystyryl ketone, a methyl derivative of eriodictyol, homoeriodictyol, and hesperitin." By Frank Tutin and Frederic William Caton.

Vanillin methyl ether, when condensed with 2 : 4 : 6-trimethoxyacetophenone, yields 2 : 4 : 6-*trimethoxyphenyl* 3 : 4-*dimethoxystyryl ketone* (m. p. 85° when air-dried, 117·5° when anhydrous), which is identical with the fully methylated product obtained from eriodictyol, homoeriodictyol, and hesperitin (compare preceding abstract).

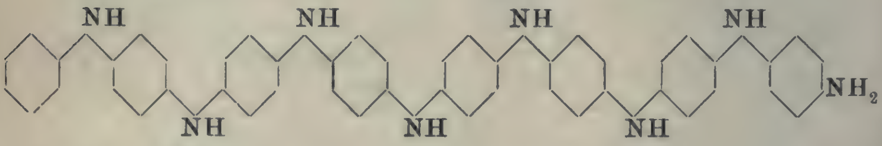
The action of aluminium chloride and acetyl chloride on phloroglucinol trimethyl ether was shown to result in the formation of a *hydroxydiacetyldimethoxybenzene* (m. p. 127—128°) possessing the following constitution:



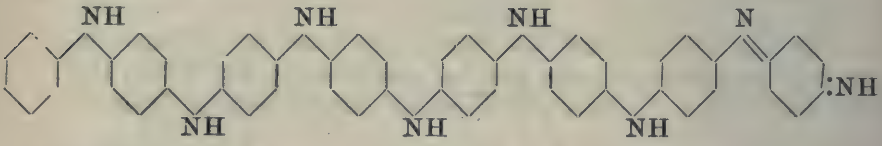
*255. "Aniline-black and allied compounds. Part I." By Arthur George Green and Arthur Edmund Woodhead.

The authors, after reviewing and criticising the recent work of Willstätter and Dorogi on aniline-black, gave an account of the preparation of certain intermediate substances obtained in the conversion of aniline hydrochloride into aniline-black. The first product is emeraldine, and from it four other substances have been prepared, namely, two by oxidation, nigraniline and pernigraniline, and two by reduction, protoemeraldine and leucoemeraldine. All these compounds form a series, any member of which can be converted into any other by the use of a suitable oxidising or reducing agent. With the view of finding their molecular weight and probable constitution, these compounds have been analysed by determining the amount of hydrogen necessary to convert the more highly oxidised substances into less highly oxidised ones, and, conversely, the amount of oxygen required to oxidise the latter. From the results obtained, the following formulæ are assigned:

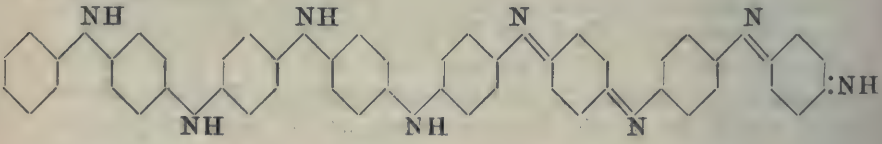
Leucoemeraldine:



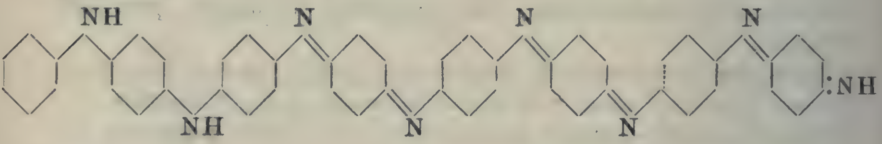
Protoemeraldine:



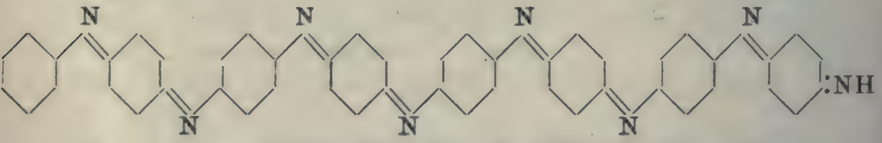
Emeraldine:



Nigraniline:



Pernigraniline:



The question as to whether the chain is open or closed is, for the present, to be regarded as unsettled.

An attempt has been made to clear up the present extremely involved nomenclature relating to aniline-black and allied substances, and, further, it has been shown that the so-called "aniline blacks" of Kayser, Nietzki, Willstätter, etc., consist essentially of emeraldine and nigraniline mixed with higher condensation products of at present unknown constitution.

*256. "The colour changes of methyl-orange and methyl-red in acid solution." By Henry Thomas Tizard.

The author has measured quantitatively the changes in molecular colour of methyl-orange and methyl-red in solutions of varying concentrations of hydrogen ions.

From the results the following constants have been deduced:

	K_a.	K_b.
Methyl-orange (at 25°) .... $NMe_2 \cdot C_6H_4 \cdot N:N \cdot C_6H_4 \cdot SO_3H$	$4 \cdot 25 \times 10^{-4}$	$<10^{-14}$
Methyl-red (at 18°) .... $NMe_2 \cdot C_6H_4 \cdot N:N \cdot C_6H_4 \cdot CO_2H$	$1 \cdot 05 \times 10^{-5}$	3×10^{-13}

The value of methyl-red as an indicator was discussed, and it was shown that its "neutral point" lies between concentrations of hydrogen ions of $10^{-5 \cdot 7}$ and 10^{-7}, which are very close to one another and to the theoretical neutral point at 10^{-7}.

*257. "The hydrolysis of aniline salts measured colorimetrically." By Henry Thomas Tizard.

The author has applied the results of the preceding paper to the colorimetric measurement of the hydrolysis of aniline hydrochloride and acetate in aqueous solution.

A determination of the depth of colour of methyl-orange in such solutions gives directly the concentration of hydrogen ion. The method compares well in accuracy with other methods for measuring hydrolysis when the base used is weaker than ammonia, as in the salts examined; at the same time measurements can be made easily and quickly.

The results of Veley and other investigators in this field were discussed.

Discussion.

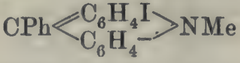
Mr. Baron asked whether the author had, in comparing the depth of colour, considered the effect of fluorescence in the indicator employed.

Mr. Tizard, in reply, said that he had not observed any fluorescence in carrying out the experiments.

258. "The structure of xanthonium and acridinium salts." (Preliminary note.) By John Theodore Hewitt and Ferdinand Bernard Thole.

The compounds formed by xanthenol and its derivatives with mineral acids, water being eliminated, have generally been regarded as oxonium salts (Hewitt, *Zeitsch. physikal. Chem.*, 1900, **34**, 9; Decker, *Ber.*, 1901, **34**, 3300). Gomberg and Cone claim that they are carbonium compounds (*Annalen*, 1909, **370**, 142), recognising the analogy to the acridinium compounds; the latter also receive a carbonium structure from these authors.

Kehrmann (*Annalen*, 1910, **372**, 287) opposes this view, and the present authors find that whilst phenylxanthenol and phenylmethylacridol give nearly the same absorption spectra, acids effect a change in these spectra, pointing to the salts formed in the two cases having similar constitutions. Since the view that methyl iodide forms an additive product with phenylacridine of the constitution



$$\mathrm{CPh}{<}\begin{matrix}\mathrm{C_6H_4I}\\ \mathrm{C_6H_4}-\end{matrix}{>}\mathrm{NMe}$$

seems untenable, the present authors agree with Kehrmann in preferring to retain an oxonium structure for the salts obtained from xanthenol and its derivatives.

Amino-derivatives of both series are under investigation.

259. "The application of viscometry to the measurement of the rate of reaction." (Preliminary note.) By Albert Ernest Dunstan.

With the object of introducing a method for the measurement of reaction velocities which will be applicable to cases where difficulties may be met with in the chemical determination of the concentrations of the reacting compounds, and will also be free from the necessity of using a substance foreign to the reaction as an indicator of the course of events, the author has studied the viscosity–time curves for many reactions, amongst which are: (1) moto-isomeric change; (2) isodynamic change of ethyl acetoacetate, ethyl malonate, and acetylacetone after distillation; (3) tautomeric change of dextrose and lactose in aqueous solution; (4) hydration of aldehydes; (5) formation of thiocarbamide and carbamide from ammonium thiocyanate and ammonium cyanate respectively; (6) the benzidine transformation. In those examples where the viscosity of the end product or equilibrium mixture is sufficiently different from that of the initial compound, it is possible to calculate a velocity-constant.

260. "Iodoacenaphthene."
By Holland Crompton and Muriel Kate Harrison.

Iodine acts on acenaphthene in the presence of yellow mercuric oxide. The acenaphthene is dissolved in boiling methyl alcohol, the solution is slightly cooled, and then a mixture of iodine (1 mol.) with rather more than the calculated amount of mercuric oxide is gradually added. The solution is finally raised to the boiling point and filtered. The crude iodoacenaphthene which crystallises out is first freed from mercuric iodide by dissolving it in cold chloroform, and then purified by crystallisation from methyl or ethyl alcohol. A complete purification is best effected by converting it into the picrate, crystallising this from alcohol, and then washing out the picric acid with ammonia.

Iodoacenaphthene, $C_{12}H_9I$, crystallises from alcohol in colourless needles or prisms. Fine, highly refractive, prismatic crystals are obtained on slow evaporation of an ethyl acetate solution. It melts at 65·5°, and decomposes at a little above 180°, with copious liberation of iodine. The *picrate* crystallises in fine, orange-red needles, melting at 102·5°. It is gradually decomposed on crystallisation from alcohol. On oxidation by sodium dichromate in acetic acid solution, an iodonaphthalic acid is obtained, the anhydride of which melts at 231°. The copper salt of this acid, on heating with soda-lime, gave naphthalene and an oil which was obtained in too small an amount for identification. On fusing the acid with potassium hydroxide at 260°, 4-hydroxynaphthalic acid was obtained. From this it is probable that the acid is 4-iodonaphthalic acid derived from 4-iodoacenaphthene. It has been found, however, that whilst 4-chloro- and 4-bromo-acenaphthene form isomorphous mixtures with one another, they are not isomorphous with the iodoacenaphthene which is here described. Further experiments are therefore being undertaken to investigate the constitution of this compound.

261. "An improved form of extraction apparatus."
By James McConnell Sanders.

The form of extraction apparatus illustrated in the accompanying diagram possesses several advantages over the usual form of Soxhlet extractor, or similar appliances in which the substance to be extracted is contained in a vertical tube the upper orifice of which is closed by the cork carrying the reflux condenser, the cork having to be removed each time a fresh quantity of material has to be introduced.

Fig. 1 shows the simpler form of apparatus, which when once mounted with its condenser is always ready for use; successive quantities of material may be introduced by simply removing the glass stopper *D*, the extraction being carried on with the tap *A* closed, when the apparatus acts as an intermittent extractor. When extraction is complete, the tap *A* is opened, and the solvent distilled off directly through the side-tube.

When using very volatile solvents, such as ether or carbon disulphide, the subsequent distillation of the solvent is facilitated by removing the cartridge containing the exhausted material, and substituting a glass boiling tube containing cold water or crushed ice.

The more elaborate form shown in Fig. 2 has two taps *B* and *C*, and when both these are kept closed the tubes *t*, *t* act as a siphon, and the extractor works intermittently. With *C* closed and *B* open, the apparatus works as a continuous extractor, or can be used also as a reflux condenser, especially if an inner tube containing cold water or ice is used.

With *B* closed and *C* open, the apparatus can be used for distilling off the solvent, as described in the case of Fig. 1.

In the author's laboratory a large model constructed of tinned copper has been in use for several months, and has proved of great value in cases where the probable amount of extractive matter was unknown, since in the event of too small a quantity of material being taken in the first instance, it was an easy matter to place a succession of weighed cartridges in the extractor and extract with the same amount of solvent without dismounting the apparatus. This copper extractor has an internal capacity of 1000 c.c., and in order to adapt it for use with smaller quantities of material a number of "dummy" cartridges of thin sheet copper are used to fill up a certain amount of space before placing the material in position.

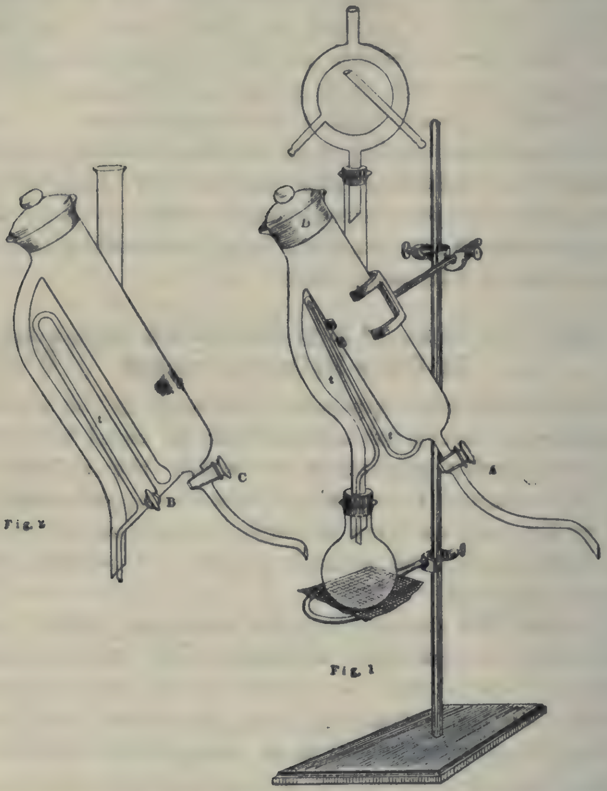


Fig. 2

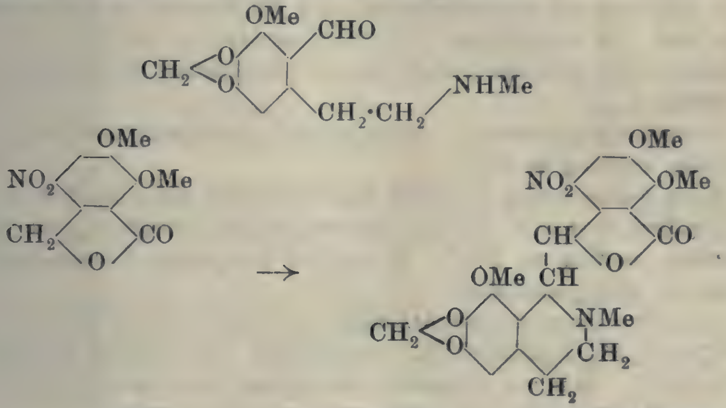
Fig. 1

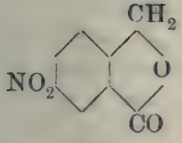
262. "The synthesis of nitrognoscopine and allied substances." (Preliminary note.) By Edward Hope and Robert Robinson.

The synthesis of gnoscopine (*r*-narcotine) has recently been accomplished (Perkin and Robinson, this vol., p. 46) by the condensation of cotarnine and meconine with the aid of potassium carbonate in alcoholic solution.

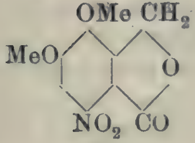
The present authors have observed that the condensation of cotarnine and nitrophthalides or their methoxy-derivatives occurs with very much greater facility.

Thus, nitrognoscopine is obtained in practically quantitative yields by boiling equimolecular quantities of cotarnine and nitromeconine in alcoholic solution for a few minutes. The reaction proceeds in accordance with the following scheme:

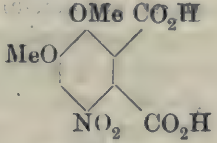




(I.)



(II.)



(III.)

The nitromeconine may be replaced by 5-nitrophthalide (I) or by nitro-ψ-meconine (II), the constitution of which is demonstrated by its oxidation with permanganate to the known nitrohemipinic acid (III).

It is clear therefore that the nitro-group may be in the ortho-, meta-, or para-position in relation to the reactive $\cdot CH_2\cdot$ group of the phthalide ring.

Nitrognoscopine, $CH_2{:}O_2{:}C_{18}H_{11}O_2(OMe)_3\cdot NO_2$, is very sparingly soluble in boiling alcohol and the usual organic solvents, but crystallises from hot trichloroethylene in bright yellow prisms, which melt and decompose to a red liquid at 191°. It is readily decomposed by warm glacial acetic acid, yielding cotarnine and nitromeconine.

The sparingly soluble, pale yellow *hydrochloride*, the *aurichloride*, and *picrate* have been prepared and analysed.

The methiodide, $CH_2{:}O_2{:}C_{18}H_{11}O_2(OMe)_3\cdot NO_2,MeI$, is a yellow, crystalline powder, which melts at 205—206°.

On boiling with silver chloride in aqueous solution, the *metho-*

chloride and silver iodide are obtained, and the addition of sodium hydroxide to the cooled and filtered solution gives a yellow, amorphous precipitate of the *ammonium hydroxide.* This substance dissolves in boiling water, and the solution, on cooling, deposits orange crystals of *nitronarceine*, $C_{23}H_{26}O_{10}N_2$, melting at 160—170°, and soluble both in dilute acids and alkalis.

This decomposition is entirely similar to that by which narceine is produced from narcotine or gnoscopine.

Aminognoscopine, $CH_2{:}O_2{:}C_{18}H_{11}O_2(OMe)_3{\cdot}NH_2$, is formed by the reduction of nitrognoscopine with tin and hydrochloric acid in the cold. It crystallises from ethyl acetate in colourless, lustrous prisms, melting at 205°, which are not decomposed by boiling glacial acetic acid.

Acetylaminognoscopine occurs in highly characteristic bunches of needles, melting at 198°.

Nitro-ψ-gnoscopine, prepared from cotarnine and nitro-ψ-meconine, crystallises from a mixture of chloroform and alcohol in pale yellow needles, melting at 184°. In general properties it resembles the isomeric nitrognoscopine.

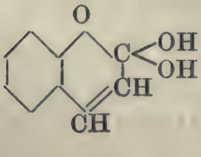
Anhydrocotarninenitrophthalide (*nitrodesdimethoxygnoscopine*), $CH_2{:}O_2{:}C_{18}H_{11}O_2(OMe){\cdot}NO_2$, crystallises in prisms melting at 176—177°. It is not so readily decomposed into its constituents by means of hot glacial acetic acid as is nitrognoscopine.

Anhydrocotarnineaminophthalide, $CH_2{:}O_2{:}C_{18}H_{11}O_2(OMe){\cdot}NH_2$, is prepared by reducing the nitro-compound with stannous chloride in glacial acetic acid solution. It crystallises from a mixture of chloroform and alcohol in rectangular plates, melting at 216—218°.

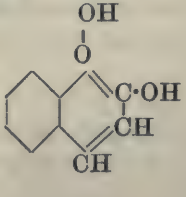
The products of these remarkable condensations are being studied in detail especially with a view to the elimination of the nitro-group and the consequent synthesis of some new alkaloids allied to narcotine and hydrastine.

263. "The constitution of coumarinic acid." By Arthur Clayton.

Two methyl ethyl ether-esters of 5-nitrocoumarinic acid have been prepared. Michael's formula (I) for coumarinic acid is therefore incorrect. The dimethyl ether-esters of 5-nitrocoumarinic acid and



(I.



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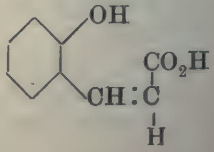


(III.)

5-nitrocoumaric acid form the same bromine additive compound. Formula II is thus excluded, and coumarinic acid is proved to be a *cis*-isomeride of *o*-coumaric acid (formula III).

264. "The reduction of chloric acid." By Ralph Roscoe Enfield.

A dilute solution of chloric acid free from the presence of other acids is not reduced by sodium amalgam. A dilute solution of chloric acid may be kept in contact with methyl alcohol for several days without any reduction taking place. The velocity of reduction of chloric acid is increased by the addition of other acids. It is suggested that this stimulating effect may be due

(1) To the mass action of the hydrogen ions in increasing the concentration of non-ionised chloric acid, on the assumption that the primary reaction is the breaking down of the non-ionised chloric acid molecule, or

(2) To the purely catalytic action of the hydrogen ions, on the assumption that the reaction is an ionic one, the reduction being that of the ClO_3 ion.

The velocity of reduction of chloric acid by methyl alcohol in presence of certain concentrations of other acids was measured. Experiments were made for nitric, sulphuric, benzenesulphonic, and oxalic acids. The stimulating effects of these acids were found to be in the order of their relative strengths. The reaction between chloric acid and ferrous sulphate was examined in the same way, and the acceleration of the reaction by various acids was determined. Acceleration constants for the various acids were calculated, and shown to be in moderate agreement with the affinity constants of the acids.

These results appear to favour the view that the reduction is that of the ClO_3 ion, accelerated by the catalytic influence of hydrogen ions.

265. "The dynamics of the decomposition of persulphuric acid and its salts in aqueous solution." By Leila Green and Orme Masson.

The authors confirm Levi and Migliorini's work (*Gazzetta*, 1906, **36**, ii, 599) as to the simple unimolecular character of the decomposition in aqueous solution of sodium, potassium, and ammonium persulphates, and as to the large acceleration produced by added acids.

The decomposition of persulphuric acid differs from that of the sodium or potassium salt in being only apparently unimolecular, since its velocity-coefficient varies with the initial concentration, and is the sum of a true unimolecular constant (k_2) and a quantity proportional to this concentration (kA); also k_2 is nearly twice as large as the k_1 of the salts of the alkali metals.

The barium salt yields a curve with marked change of flexure, showing large auto-acceleration, until, when the action is half completed, all the barium has been precipitated as sulphate, and a solution of pure persulphuric acid is obtained.

The authors suggest a theory which explains quantitatively these cases and also those of most of the mixtures studied. Each salt has its own normal unimolecular constant, which is increased by a quantity proportional to the hydrogen ions, or acid accelerator, present. The acid sulphate, which is an essential product of the action, and yet shows no catalytic effect (even although added at the outset), does not reckon in this connexion as an acid, whilst added sulphuric acid counts only as a monobasic acid. Persulphuric acid has its full dibasic value.

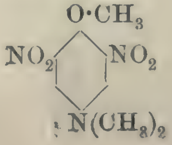
The addition of alkalis does not alter the simple unimolecular character of the decomposition of the sodium or potassium salt, and hardly changes the value of the constant. Barium persulphate, when mixed with barium hydroxide, shows a much larger initial rate of decomposition than the pure salt, and there is also further auto-acceleration.

Most of the work was carried out at 80°. At 90° the velocities are practically ten times as great as at 70°.

266. "Complete methylation by methyl sulphate."

By Raphael Meldola.

In the course of some experiments having for their object the preparation of compounds containing an asymmetric quinquevalent nitrogen atom combined with at least one strongly acid radicle, it became necessary to obtain, if possible, a mono-alkylated 2: 6-dinitro-4-aminophenol (*iso*picramic acid). Some of the latter was accordingly treated with methyl sulphate and alkali in the usual way, the quantity of methyl sulphate being a little in excess of that required to introduce one methyl group. It was thought that the protective action of the nitro-groups might possibly prevent the methylation of the hydroxyl and direct the methyl group into the 4-amino-group. It was found, however, that the product was non-phenolic, and further examination showed that three methyl groups had entered the molecule, the unmethylated portion being mainly, but not entirely, unchanged *iso*picramic acid. The tendency in this case is for complete methylation to take place, the yield of trimethyl derivative being very high, in spite of the deficiency of methyl sulphate. The compound is accordingly 2: 6-*dinitrodimethyl*-p-*anisidine*,



0·0472 gave 7 c.c. N_2 (moist) at 13° and 761·7 mm. N = 17·56.

$C_9H_{11}O_5N_3$ requires N = 17·43 per cent.

The substance is basic, dissolving in mineral acid to a clear solution, from which orange needles separate on neutralisation with ammonia. The melting point of the pure compound is above 300°.

267. "A study of the dissociation of the salts of hydroxylamine in aqueous solution." By Ernest Barrett.

The work is an outcome of the previously recorded influence of acids and alkalis on the rate of formation of acetoxime (Barrett and Lapworth, *Trans.*, 1908, **93**, 85). Aqueous solutions of hydroxylamine sulphate and hydrochloride, to which various fractions of a molecular equivalent of alkali had been added, were examined as to their electrolytic conductivity and degree of acidity, the latter colorimetrically, using *o*-nitrophenol as indicator. Whilst the first method gave a normal result, the latter method indicated that the gradual addition of alkali to hydroxylamine hydrochloride does not produce a steady rise in the alkalinity of the solution, but that strongly marked maxima and minima occur.

268. "The colour and constitution of bromine solutions." By Alfred Francis Joseph and James Nadoris Jinendradasa.

On adding a soluble bromide to aqueous bromine, the colour becomes lighter. This seems probably due to the formation of a polybromide which is lighter in colour than free bromine.

The colour of bromine water was compared with that of solutions of bromine in aqueous bromides (using potassium dichromate as an intermediate standard), and it was found that after the concentration of the bromide reached normal, further addition produced little effect on the colour. This agrees with the view that in normal bromide solution the bromine is practically wholly combined.

The colorimetric results applied to the dissociation equation $k(KBr_3) = (KBr) \times (Br_2)$ give values of k varying from 0·03 to 0·07, which are similar to those obtained by Worley in the study of the strength of solutions of equal vapour pressure. Potassium and sodium bromides and hydrobromic acid gave similar results.

269. "The reactivity of ketones towards iodine and the relative rates of tautomeric change." By Harry Medforth Dawson and Robert Wheatley.

The rate at which iodine reacts with various ketones in aqueous alcoholic solution has been measured in the presence of sulphuric acid as a catalyst. Dimethyl, methyl ethyl, methyl propyl, methyl butyl, methyl hexyl, phenyl methyl, diethyl and phenyl ethyl ketones were examined. The mechanism of the change appears to be the same in all cases, and from the observed velocities with which the ketones react with iodine under comparable conditions, the relative rates at which the various ketones are converted from the ketonic to the enolic form have been obtained.

270. "The colour and absorption spectra of some sulphur compounds."

By John Edward Purvis, Humphrey Owen Jones, and Hubert Sanderson Tasker.

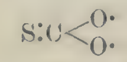
Dithio-oxalic esters have been shown to be coloured (Jones and Tasker, *Trans.*, 1909, **95**, 1904), whilst the corresponding oxalic esters are colourless; it was therefore considered of interest to examine the effect of the substitution of sulphur for oxygen in similar substances in order to obtain evidence as to the origin of the colour.

To this end twenty-two sulphur compounds of various types have been prepared and their absorption spectra examined.

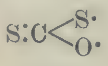
The general results obtained may be summarised as follows:

(1) The displacement of oxygen by sulphur causes a marked increase in the absorptive power of the compound, and often causes the production of an absorption band and of colour.

(2) Definite absorption bands are given by sulphur compounds having the following structures, but are not exhibited by the corresponding oxygen compounds:


$\mathrm{S{:}C}<\begin{smallmatrix}\mathrm{O\cdot}\\ \mathrm{O\cdot}\end{smallmatrix}$

(I.)


$\mathrm{S{:}C}<\begin{smallmatrix}\mathrm{S\cdot}\\ \mathrm{O\cdot}\end{smallmatrix}$

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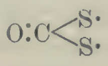
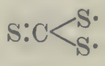
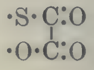

$\mathrm{O{:}C}<\begin{smallmatrix}\mathrm{S\cdot}\\ \mathrm{S\cdot}\end{smallmatrix}$

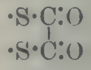
(III.)


$\mathrm{S{:}C}<\begin{smallmatrix}\mathrm{S\cdot}\\ \mathrm{S\cdot}\end{smallmatrix}$

(IV.)


$\begin{matrix}\mathrm{\cdot S\cdot C{:}O}\\ |\\ \mathrm{\cdot O\cdot C{:}O}\end{matrix}$

(V.)


$\begin{matrix}\mathrm{\cdot S\cdot C{:}O}\\ |\\ \mathrm{\cdot S\cdot C{:}O}\end{matrix}$

(VI.)

Of these, compounds of the types I, II, IV, and VI are yellow, and V may be considered as faintly yellow in colour.

(3) The group C:S must be considered a powerful chromophore.

(4) In certain aromatic compounds, such as phenol and benzyl alcohol, the displacement of oxygen by sulphur results in the obliteration of absorption bands, which is probably due to the increase in general absorption.

(5) Oxalyl chloride, which is itself colourless, gives yellow solutions with a number of unsaturated compounds and compounds containing oxygen or sulphur.

271. "The interaction of phenyl mercaptan and thionyl chloride."

By Hubert Sanderson Tasker and Humphrey Owen Jones.

As a result of an examination of the interaction of phenyl mercaptan and thionyl chloride (*Trans.*, 1909, **95**, 1911), the authors concluded that the change could be partly represented by the equation $8C_6H_5\cdot SH + 4SOCl_2 = 8HCl + 2SO_2 + 3(C_6H_5\cdot S)_2 + (C_6H_5)_2S_4$, and suggested that sulphur dioxide was produced by the decomposition of sulphur suboxide (SO), which might be formed momentarily.

The evidence in support of this was as follows:

(1) The titre of the products of the interaction for alkali and for iodine was approximately that required by the above equation.

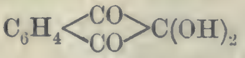
(2) The liquid product of the reaction had the properties and composition of diphenyl tetrasulphide.

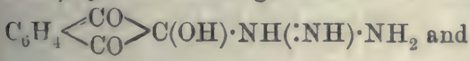
(3) When thionyl chloride reacts with lead phenylmercaptide, $Pb(S\cdot C_6H_5)_2$, or with nickel carbonyl, sulphur dioxide is formed, and in the latter case sulphur is also produced. In both cases it would appear that sulphur dioxide has been produced by the decomposition of sulphur suboxide.

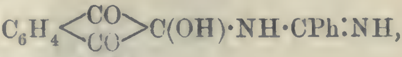
In a recent paper (*Trans.*, 1910, **97**, 1196) Smythe and Forster criticise these conclusions, and state that there is no reason to believe that the reaction is not completely represented by Holmberg's equation (*Annalen*, 1907, **359**, 81): $4RSH + SOCl_2 = R_2S_2 + R_2S_3 + H_2O + 2HCl$.

These authors have, however, entirely overlooked the evidence mentioned under (2) and (3) above, and also the fact that water was always present at the end of the reaction, and that therefore all the sulphur dioxide could not have been due to the secondary interaction between water and thionyl chloride.

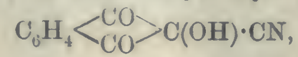
272. "Triketohydrindene hydrate." By Siegfried Ruhemann.

Triketohydrindene hydrate,  $C_6H_4{<}\genfrac{}{}{0pt}{}{CO}{CO}{>}C(OH)_2$ (*Trans.*, 1910, **97**, 1438), yields with guanidine or benzamidine the compounds:

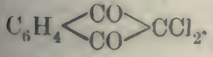

$C_6H_4{<}\genfrac{}{}{0pt}{}{CO}{CO}{>}C(OH)\cdot NH(:NH)\cdot NH_2$ and

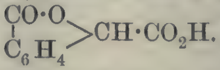

$C_6H_4{<}\genfrac{}{}{0pt}{}{CO}{CO}{>}C(OH)\cdot NH\cdot CPh:NH$,

with hydrogen cyanide, the unstable cyanohydrin,


$C_6H_4{<}\genfrac{}{}{0pt}{}{CO}{CO}{>}C(OH)\cdot CN$,

and with phosphorus pentachloride, 2 : 2-dichloro-1 : 3-diketohydrindene,


$C_6H_4{<}\genfrac{}{}{0pt}{}{CO}{CO}{>}CCl_2$.

The action of potassium hydroxide on triketohydrindene hydrate proceeds in three distinct phases, which are indicated by colour changes. First, a yellow coloration is formed, which is due to the production of phenylglyoxal-*o*-carboxylic acid, $CO_2H\cdot C_6H_4\cdot CO\cdot CHO$, then the solution becomes blue, and finally colourless. The colourless liquid contains the potassium salt of *o*-carboxymandelic acid, $CO_2H\cdot C_6H_4\cdot CH(OH)\cdot CO_2H$, because, with dilute sulphuric acid, it yields phthalidecarboxylic acid,  $\begin{matrix}CO\cdot O \\ | \\ C_6H_4\end{matrix}\!>\!CH\cdot CO_2H$. As regards the intermediate phase of the reaction, which is characterised by the blue colour of the alkaline solution, the author puts forward an explanation based on the analogy to the similar reaction in the case of the diketopyrrolines, when unstable blue salts are formed.

Triketohydrindene hydrate gives an intense blue coloration with α-aminoaliphatic or aliphatic aromatic acids, whereas no coloration is obtained with substituted amino-acids, for example, phenylglycine and hippuric acid, or with aromatic acids which contain the amino-group in the nucleus. So far, only two β-amino-acids have been tested, and they were found to differ, in some respects, from their isomerides, the α-amino-acids, in their behaviour towards triketohydrindene hydrate.

273. "The influence of solvents on the rotation of optically active compounds. Part XVI. The relationship between the chemical constitution and the influence of a solvent." By Thomas Stewart Patterson and Elizabeth Findlay Stevenson.

The relationship between the chemical constitution and the influence, on the rotation of ethyl tartrate, of various solvents were discussed.

274. "Solubility of calcium phosphate in saturated solutions of carbon dioxide containing ammonia." By Bernard Foster and Henry Allen Dugdale Neville.

The solubility of calcium phosphate, and of the phosphates in commercial phosphatic manures, was determined in saturated solutions of carbon dioxide containing ammonia. With increasing quantities of ammonia the quantity of phosphate passing into solution increases at first rapidly, and then more slowly, the solubility of phosphate then being almost directly proportional to the amount of ammonia present.

275. "The constitution of sodium aluminate solutions."

By Roland Edgar Slade.

Hantzsch's experiments (*Zeitsch. anorg. Chem.*, 1902, **30**, 276) on the conductivity of sodium aluminate solutions have been repeated and confirmed. These experiments show that the aluminium hydroxide behaves as a monobasic acid.

The author has been unable to confirm the work of Herz (*Zeitsch. anorg. Chem.*, 1900, **25**, 155) on the existence of the compound Na_3AlO_3 in solution. The work of Russ (*Zeitsch. anorg. Chem.*, 1904, **41**, 206) and of Wood (*Trans.*, 1908, **93**, 421) on the equilibrium between crystalline aluminium hydroxide and sodium aluminate solutions was discussed. The assumptions on which Wood calculated the acidic dissociation constant of aluminium hydroxide were shown to be far from correct.

The work of Wood (*Trans.*, 1910, **97**, 878) on the acidic dissociation of the hydroxides of glucinum, zinc, and lead was similarly criticised.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Abderhalden, *Emil.* [Editor.] Handbuch der biochemischen Arbeitsmethoden. Vol. V [*Continuation of Vol. I*]. pp. xvi + 699 to 1527. ill. Berlin 1910. (*Recd.* 6/8/10.)

From the Publishers: Messrs. Urban und Schwarzenberg.

Bell, *Sir William J.* The Sale of Food and Drugs Acts, 1875 to 1907. With Notes and Cases; Together with an appendix containing the other acts relating to adulteration, chemical notes, etc. 5th edition. By *Charles F.* **Lloyd**. The chemical notes revised and enlarged by *R. A.* **Robinson**. pp. xl + 303 + 43. London 1910. (*Recd.* 20/9/10.)

From the Publishers: Messrs. Butterworth & Co.

Dyer, *Bernard.* Fertilisers and feeding stuffs. Their properties and uses. With the full text of the Fertilisers and Feeding Stuffs Act, 1906, the regulations and forms of the Board of Agriculture, and notes on the Act by *A. J.* **David**. 6th edition. pp. viii + 152. London 1910. (*Recd.* 28/6/10.) From the Author.

Elsden, *James Vincent.* Principles of chemical geology. A review of the application of the equilibrium theory to geological problems. pp. viii + 222. ill. London 1910. (*Recd.* 6/7/10.)

From the Publishers: Messrs. Whittaker & Co.

Friend, *J. Newton.* An introduction to the chemistry of paints. pp. x + 204. ill. London 1910. (*Recd.* 3/8/10.) From the Author.

Gissing, *Charles E.* Spark spectra of the metals. pp. vii + 21. ill. London 1910. (*Recd.* 13/7/10.)

From the Publishers: Messrs. Baillière, Tindall and Cox.

Haas, *Paul.* Laboratory notes on organic chemistry for medical students. pp. viii + 128. ill. London 1910. (*Recd.* 30/9/10.)

From the Author.

Holleman, *A. F.* A text-book of organic chemistry. Edited by *A. Jamieson* **Walker**, assisted by *Owen E.* **Mott**. 3rd English edition. pp. xx + 599. ill. New York 1910. (*Recd.* 12/9/10.)
From the Publishers: Messrs. John Wiley and Sons.

Howard, *Albert,* and **Howard,** *Gabrielle L. C.* Wheat in India. Its production, varieties and improvement. pp. ix + 288. ill. Calcutta 1909. (*Recd.* 23/8/10.) From the Authors.

Institute of Chemistry. Proceedings, 1877–1895. 19 vols. London. From Dr. Alexander Scott, M.A., F.R.S.

Koerner, *Guglielmo.* L'Opera Classica di Guglielmo Koerner. La determinazione del luogo chimico nei composti cosi detti aromatici. (Pubblicazioni di G. Koerner raccolte ed ordinate in occasione del 50° Anniversario della sua Laurea.) pp. 274. Milano 1910. (*Recd.* 2/8/10.) From the Committee.

Lister Institute of Preventive Medicine. Collected papers, No. 6. London 1909–10. (*Recd.* 29/8/10.) From the Institute.

Lodge, *Sir Oliver.* The ether of space. pp. xvi + 156. ill. London 1909. (*Recd.* 1/7/10.) From the Publishers: Messrs. Harper & Bros.

Martindale, *William Harrison.* Organic analysis chart. pp. 80. London 1910. (*Recd.* 6/8/10.)
From the Publishers: Messrs. H. K. Lewis.

Martindale, *William Harrison,* and **Westcott,** *W. Wynn.* The extra pharmacopœia. 14th edition. pp. xxvii + 1054. London 1910. (*Recd.* 6/8/10.) From the Publishers: Messrs. H. K. Lewis.

Moore, *F. J.* Outlines of organic chemistry. pp. ix + 315. New York 1910. (*Recd.* 16/6/10.)
From the Publishers: Messrs. John Wiley and Sons.

Moureu, *Ch.* Notions fondamentales de chimie organique. 3rd dition. pp. iv + 354. Paris 1910. (*Recd.* 4/7/10.)
From the Publishers: Messrs. Gauthier-Villars.

Perkin, *Frederick Mollwo.* Qualitative chemical analysis. 3rd edition. pp. xii + 337. ill. London 1910. (*Recd.* 23/6/10.)
From the Author.

Philip, *James Charles.* Physical chemistry. Its bearing on biology and medicine. pp. vii + 312. ill. London 1910. (*Recd.* 1/10/10.)
From the Author.

Sidgwick, *Nevil Vincent.* The organic chemistry of nitrogen. pp. xi + 415. Oxford 1910. (*Recd.* 14/10/10.)
From the Publishers: The Clarendon Press.

Smiles, *Samuel.* The relations between chemical constitution and some physical properties. pp. xiv + 583. ill. London 1910. (*Recd.* 12/6/10.) From the Author.

Thompson, *C. J. S.* The compendium of medicine and pharmacy. 3rd edition. pp. vi + 336. London [1910]. (*Recd.* 21/6/10.)
From the Publishers: Messrs. John Bale, Sons & Danielsson, Ltd.

Tilden, *Sir William A.* The elements. Speculations as to their nature and origin. pp. xi + 139. ill. London 1910. (*Recd.* 1/7/10.)
From the Publishers: Messrs. Harper & Bros.

Treadwell, *F. P.* Analytical chemistry. Volume II. Quantitative analysis. Authorised translation from the German by *William T.* **Hall.** 2nd edition. pp. x + 787. ill. New York 1910. (*Recd.* 12/9/10.) From the Publishers: Messrs. John Wiley and Sons.

II. *By Purchase.*

Allen, *Alfred Henry.* Commercial organic analysis. Vol. III. 4th edition. Edited by *William Alfred* **Davis** and *Samuel S.* **Sadtler.** pp. x + 635. ill. London 1910. (*Recd.* 3/9/10.)

Beythien, *A.* Die Nahrungsmittelverfälschung, ihre Erkennung und Bekämpfung. (Sammlung, Vol. XVI.) Stuttgart 1910.

Hamburger, *H. J.* Osmotischer Druck und Ionenlehre in den medicinischen Wissenschaften. Zugleich Lehrbuch physikalisch-chemischer Methoden. 3 vols. pp. xiii + 539, x + 516, xiii + 508. ill. Wiesbaden 1902–1904. (*Recd.* 3/8/10.)

Kayser, *H.* Handbuch der Spectroscopie. Vol. V. pp. vi + 853. ill. Leipzig 1910. (*Recd.* 20/7/10.)

Nierenstein, *M.* Chemie der Gerbstoffe. (Sammlung, Vol. XV.) Stuttgart 1910.

Oppenheimer, *Carl.* Die Fermente und ihre Wirkungen. Allgemeiner Teil. Nebst einem Sonderkapitel: Physikalische Chemie der Fermente und Fermentwirkungen von *R. O.* **Herzog.** pp. xv + 282. Leipzig 1910. (*Recd.* 11/10/10.)

Ostwald, *W.*, and **Luther**, *R.* Hand- und Hülfsbuch zur Ausführung physiko-chemischer Messungen. 3rd edition. Edited by *R.* **Luther** and *K.* **Drucker.** pp. xvi + 573. ill. Leipzig 1910. (*Recd.* 23/6/10.)

Ubbelohde, *L.*, and **Goldschmidt**, *F.* Handbuch der Chemie und Technologie der Oele und Fette. Vol. 3, part 1. pp. xx + 380. ill. Leipzig 1910. (*Recd.* 14/10/10.)

Walden, *P.* Die Lösungstheorien in ihrer geschichtlichen Aufeinanderfolge. (Sammlung, Vol. XV.) Stuttgart 1910.

III. *Pamphlets.*

Blum, *L.* Ueber den Abbau von Fettsäuren im Organismus und über die gegenseitigen Beziehungen der Azetonkörper. (From the *Münchener med. Woch.*, 1910.)

Breinl, *Anton*, and **Nierenstein**, *M.* Bio-chemical and therapeutical studies on trypanosomiasis. (From the *Ann. Trop. Med. Par.*, 1909, **3.**)

Burian, *Richard*, and **Drucker**, *Karl.* Gefrierpunktsmessungen an kleinen Flüssigkeitsmengen. (From the *Zentr. Physiol.*, 1910, **23.**)

BANQUET TO PAST PRESIDENTS.

The Banquet, which was postponed from May 26th, will be held at the Savoy Hotel (Embankment Entrance) on Friday, November 11th, 1910, at 7 for 7.30 p.m., in honour of the following Past Presidents who have attained their Jubilee as Fellows of the Society:

	Elected	Served as President
Prof. William Odling, F.R.S.	1848	1873–1875.
The Rt. Hon. Sir Henry E. Roscoe, F.R.S.	1855	1880–1882.
Sir William Crookes, F.R.S.	1857	1887–1889.
Dr. Hugo Müller, F.R.S.	1859	1885–1887.
Dr. A. G. Vernon Harcourt, F.R.S. ...	1859	1895–1897.

The price of tickets will be One Guinea (£1 1*s.*) each (including wine), or Half-a-Guinea (10*s.* 6*d.*) each (not including wine).

All applications for tickets must be received not later than Friday, November 4th, next.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, made payable to "Mr. S. E. Carr," and addressed to the Assistant Secretary, Chemical Society, Burlington House, W.

At the next Ordinary Scientific Meeting on **Thursday**, November 3rd, 1910, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Researches on bleaching powder." By R. L. Taylor.

"Azomethine azo-dyes." By A. G. Green and R. N. Sen.

"Syntheses in the epinephrine series. Part II. The formation and properties of some 2 : 5- and 2 : 6-substituted pyrazines and their conversion into amino-ketones and imino-diketones." By F. Tutin.

"The absorption spectra of some substituted pyrazines and their salts." By F. Tutin and F. W. Caton.

"Studies in the camphane series. Part XXVIII. Stereoisomeric hydrazones and semicarbazones of camphorquinone." By M. O. Forster and A. Zimmerli.

"The constituents of gelsemium." By C. W. Moore.

"Some phenolic derivatives of β-phenylethylamine." By G. Barger and A. J. Ewins.

"Chloroamine reactions. Methylenechloroamine." By C. F. Cross and E. J. Bevan.

"Preparation of secondary amines from carboxylic acids. Part I. Preparation of heptadecylaniline, pentadecylaniline, and tridecylaniline." By H. R. Le Sueur.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E C., AND BUNGAY, SUFFOLK.

Issued 11/11/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 376.

Thursday November 3rd, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. Charles W. Meanwell and R. O'F. Oakley were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Bertram Haward Buttle, 63, Claremont Road, Forest Gate, E.
Frank Anthony Camp, c/o Messrs. Parry & Co., Madras, India.
David Chalmers Crawford, M.A., B.Sc., Elsenburg, Mulders Vlei, Cape Colony.
Arthur Dodd, Lyndhurst, Belvedere, Kent.
Fred Holt, B.Sc., 28, Mere Street, Rochdale.
Prince Mahmood Ali Khan, B.A., Zafermanzl, Rampur State, U.P. India.
James Eckersley Myers, B.Sc., Acresfield, Gatley, Cheshire.
Sidney Herbert Newman, B.Sc., 181, Brooke Road, Upper Clapton, N.E.
Alfred Oswald Ransome, Beechwood, Greenock Road, Paisley.
Rajendra Nath Sen, M.A., M.Sc., 41, Machuabazar Street, Calcutta.
Arthur Bernard Williams, Coychurch Rectory, Bridgend, S. Wales.

Of the following papers, those marked * were read:

*276. "Researches on bleaching powder."

By Robert Llewellyn Taylor.

The author has investigated the action of carbon dioxide and of air on bleaching powder.

When carbon dioxide acts on bleaching powder, either solid or in solution, nothing but chlorine is evolved. The conclusion is drawn that the action of carbonic acid is exactly like the action of any other acid, hydrochloric and hypochlorous acids being produced and decomposing each other with the liberation of chlorine. Hence the action of hydrochloric acid on carbonates is a reversible one.

Air free from carbon dioxide sweeps out very slowly a little hypochlorous acid from a solution of bleaching powder. This is due to the hydrolysis of the hypochlorite in the solution. Ordinary moist air liberates from solid bleaching powder at first a mixture of hypochlorous acid and chlorine, and finally nothing but chlorine. In aqueous solution the action is almost the same.

It was shown that the action of bromine on alkalis is a reversible one, and the conclusion is drawn that the action of chlorine is the same. The carbon dioxide in air unites with the free lime, and then the calcium chloride present reverses the action, liberating chlorine.

Air free from carbon dioxide expels a considerable amount of chlorine from a solution of bleaching powder, from which some of the free lime has been removed. Such a solution bleaches more rapidly than an ordinary solution, and calcium chloride or salt added to it helps to reverse the action, liberating more chlorine, and further stimulating the bleaching action. In the ordinary bleaching process, chlorine is probably the active bleaching agent, hypochlorous acid only playing a minor part.

DISCUSSION.

The PRESIDENT asked whether the author thought it necessary to assume that carbonic acid had the power of decomposing sodium or calcium chloride, when he had shown that carbonic acid liberated chlorine from a solution of bleaching powder by combining with the free hydrate, and so reversing the action of chlorine on calcium hydrate:

$$2Ca(OH)_2 + 2Cl_2 \rightleftharpoons CaCl_2 + Ca(OCl)_2 + 2H_2O.$$

DR. SENTER, referring to the author's view that carbon dioxide liberates both hydrochloric and hypochlorous acids from bleaching powder, said that it did not seem justifiable to adduce as evidence in favour of this suggestion the fact that carbon dioxide turns methyl-orange red in presence of sodium chloride. It could be shown (compare Bohdan von Szyszkowski, *Zeitsch. physikal. Chem.*, 1910, **73**, 273) that, so far as purely chemical interchange between the components is concerned, the hydrogen-ion concentration in a solution containing carbon dioxide and sodium chloride is less than for the carbon dioxide alone in water. The observed effect on methyl-orange must therefore be ascribed to some other factor, doubtless to the so-called "neutral salt action" illustrated, for example, by the observation of Arrhenius that the catalytic action of acetic acid is increased by the addition of salts, such as sodium chloride. In the present case the neutral salt probably acts by increasing the dissociating power of the medium. The effect on methyl-orange is therefore to be ascribed to increased ionisation of the carbonic acid in the salt solution, and not to the liberation of hydrochloric acid from the sodium chloride.

Prof. GREEN could confirm Mr. Taylor's view of the reversibility of the reaction between halogens and alkalis, at least in the case of bromine and iodine. Thus an alkaline solution of iodine gave the starch reaction even in presence of a considerable excess of alkali hydroxide.

Mr. TAYLOR, in reply, stated that whilst he had shown that the carbon dioxide in the air caused the liberation of chlorine in the way described, yet the action of pure carbonic acid on bleaching powder was so very much more rapid than that of air that it suggested a complete decomposition (such as is produced by other acids) rather than the reversed action which was induced by the removal of the free lime. The equation quoted by the President did not necessarily represent what took place when bleaching powder was made, but simply the condition of equilibrium in which it existed in solution.

*277. "Azomethineazo-dyes."

By Arthur George Green and Rajendra Nath Sen.

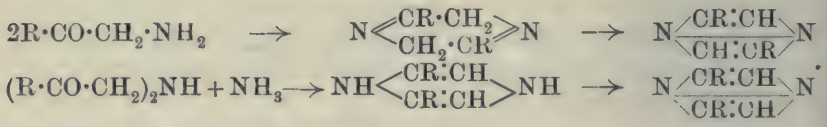
In order to investigate the effect on the colour and dyeing properties brought about by the simultaneous presence in a compound of the azomethine and azo-groups, the authors have prepared and examined a number of dyes obtained by condensing phenetoleazobenzaldehydesulphonic acid, $OEt\cdot C_6H_4\cdot N_2\cdot C_6H_3(SO_3H)\cdot CHO$, with various amines and diamines. These compounds, of various complexity, are all yellow, crystalline products, which dye wool readily in fast shades. Affinity for cotton is only manifested when the compound is derived from a para-diamine. The introduction of an auxochromic group (OH or NMe_2) has practically no effect on the dyeing properties, and does not increase the tinctorial power, augment the affinity, or change the shade. Moreover, the colour is almost independent of the number of azomethine groups in the molecule. The members of the series which do not contain an auxochromic group possess, like the azo-dyes of the stilbene class, to which they have some structural analogy, a considerable degree of fastness to alkalis, light, and chlorine.

Discussion.

Prof. Green said, in reply to Dr. Cain, that the colour of the azomethineazo-dyes was uninfluenced by the introduction of naphthalene nuclei in the molecule. The ethoxy-group did not act as an auxochrome in these compounds. Ethoxy-groups apparently only exhibited auxochromic action when they could act as salt-forming groups by combination with acids.

*278. "Syntheses in the epinephrine series. Part II. The formation and properties of some 2 : 5- and 2 : 6-substituted pyrazines and their conversion into amino-ketones and imino-diketones." By Frank Tutin.

ω-Chloroacetophenone, ω-chloro-*p*-methoxyacetophenone, and *ω-chloro*-mp-*dimethoxyacetophenone*, when heated with ammonia, yield mixtures of 2 : 5- and 2 : 6-substituted pyrazines. The two series of reactions involved proceed as follows, after replacement of the halogen:



$$2R\cdot CO\cdot CH_2\cdot NH_2 \longrightarrow N\left\langle\begin{matrix}CR\cdot CH_2\\ CH_2\cdot CR\end{matrix}\right\rangle N \longrightarrow N\left\langle\begin{matrix}CR{:}CH\\ CH{:}CR\end{matrix}\right\rangle N$$

$$(R\cdot CO\cdot CH_2)_2NH + NH_3 \longrightarrow NH\left\langle\begin{matrix}CR{:}CH\\ CR{:}CH\end{matrix}\right\rangle NH \longrightarrow N\left\langle\begin{matrix}CR{:}CH\\ CR{:}CH\end{matrix}\right\rangle N$$

2 : 5-Diphenylpyrazine, 2 : 6-diphenylpyrazine, pp′-*dimethoxy*-2 : 5-*diphenylpyrazine*, pp′-*dimethoxy*-2 : 6-*diphenylpyrazine*, mm′pp′-*tetramethoxy*-2 : 5-*diphenylpyrazine*, and mm′pp′-*tetramethoxy*-2 : 6-*diphenylpyrazine* have thus been prepared.

The reactions represented above can be reversed: by treatment with hydriodic acid the pyrazine derivatives mentioned yield respectively the *hydriodides* of the following bases: ω-aminoacetophenone, diphenacylamine, ω-amino-*p*-hydroxyacetophenone, pp′-*dihydroxydiphenacylamine*, ω-amino-*mp*-dihydroxyacetophenone, and mm′pp′-*tetrahydroxydiphenacylamine*.

Diphenacylamine and its derivatives, when heated with ammonia, yield 2 : 6-substituted pyrazines.

ω-Chloro-o-methoxyacetophenone and *ω-chloro*-op-*dimethoxyacetophenone* yield only resinous products when heated with ammonia, but, through the agency of potassium phthalimide, salts and derivatives of *ω-amino-o-hydroxyacetophenone* and *ω-amino-*op-*dihydroxyacetophenone* have been prepared from these chloro-ketones.

The last-mentioned two bases, when dissolved, pass spontaneously into oo′*-dihydroxy-*2 : 5*-diphenylpyrazine* and oo′pp′*-tetrahydroxy-*2 : 5*-diphenylpyrazine* respectively.

All the hydroxy-ketonic bases mentioned, with the exception of ω-amino-*o*-hydroxyacetophenone, are physiologically active.

pp′-Dihydroxy-2 : 5-diphenylpyrazine, on fusion, passes into a "liquid-crystalline" state, which persists over a range of 41·4°.

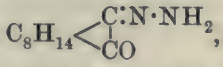
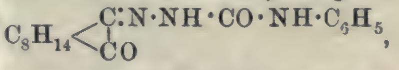
Numerous salts and derivatives of the compounds mentioned above were described.

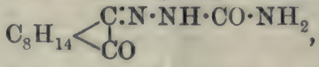
*279. "The absorption spectra of some substituted pyrazines and their salts." By Frank Tutin and Frederic William Caton.

The authors have examined the absorption spectra of 2 : 6-diphenylpyrazine, *pp*′-dimethoxy-2 : 6-diphenylpyrazine, and *mm′pp*′-tetramethoxy-2 : 6-diphenylpyrazine, and of the monohydrochlorides and monohydrobromides of these bases. 2 : 5-Diphenylpyrazine and its monohydrochloride, and *pp*′-dimethoxy-2 : 5-diphenylpyrazine and the corresponding salts of this base have also been examined spectroscopically.

A number of mono- and di-acid salts of the above-mentioned bases, and of *mm′pp*′-tetramethoxy-2 : 5-diphenylpyrazine were described.

*280. "Studies in the camphane series. Part XXVIII. Stereoisomeric hydrazones and semicarbazones of camphorquinone." By Martin Onslow Forster and Adolf Zimmerli.

The *a-* and *β-camphorquinonehydrazones,*  $C_8H_{14}<\begin{matrix}C{:}N\cdot NH_2\\ \vert\\ CO\end{matrix}$, produced simultaneously by the action of hydrazine hydrate on the diketone, and melting at 206° and 102° respectively, are interconvertible by heat. Phenylcarbimide transforms them into the *a-* and *β-camphorquinonephenylcarbamylhydrazones,*  $C_8H_{14}<\begin{matrix}C{:}N\cdot NH\cdot CO\cdot NH\cdot C_6H_5\\ \vert\\ CO\end{matrix}$, melting at 211° and 161° respectively, a mixture of which is produced by the condensation of camphorquinone with phenylcarbamylhydrazide, and also by the action of hot aniline on the camphorquinonesemicarbazones. One of the last-named substances, the *a*-compound, has been already described by Lapworth and Chapman (*Trans.*, 1901, **79**, 381), and melts at 236°, whilst the *β-camphorquinonesemicarbazone*,



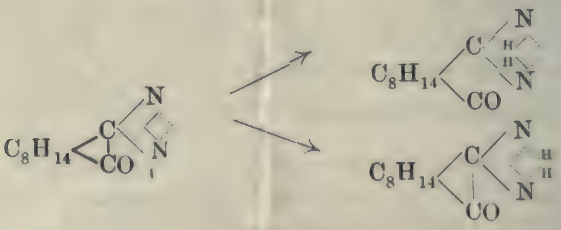
$$C_8H_{14}<\begin{matrix}C{:}N{\cdot}NH{\cdot}CO{\cdot}NH_2\\ |\\ CO\end{matrix},$$

melts at 147°, and is converted into the α-modification at temperatures between these melting points. Each semicarbazone is transformed into the acetyl derivative of the corresponding hydrazone by hot acetic anhydride, and of these the *α-acetylhydrazone* (m. p. 239°) is changed into the *β-acetylhydrazone* (m. p. 150°) by acetic anhydride, the converse transformation being effected by heat.

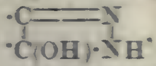
Both hydrazones are oxidised immediately to diazocamphor by cold aqueous mercury acetamide, and they are both regenerated from the diazo-compound by reduction with alcoholic ammonium sulphide. In view of these relationships, and since the members of each pair of hydrazones, semicarbazones, and phenylcarbamylhydrazones differ but little from one another in optical activity, whilst the only chemical distinction hitherto brought to light is the transformation of the β-semicarbazone into camphane-oxytriazine by alkalis, which leave the α-semicarbazone unaltered, the authors believe that stereoisomerism prevails in this group, and that their experiments give support to the Hantzsch-Werner hypothesis.

Discussion.

Mr. W. Robertson submitted that the authors had not proved their case. In the first instance, the conclusion drawn that the α- and β-compounds were not polymerides had yet to be definitely established; the wide differences in solubility and in melting point were at variance with this conclusion. Exception was also taken to the dismissal of the "phane" formula for the hydrazone on the evidence available. Moreover, if the Hantzsch-Werner tetrahedral configuration of the nitrogen atom, postulated by the authors, were examined, there were two "phane" hydrazones possible according to the linking broken on the reduction of the diazocamphor:

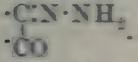


Thus there should be four, not two, isomeric hydrazones of camphorquinone capable of existence on this hypothesis. Another constitution for a hydrazone was suggested as worthy of consideration, namely,



$$\begin{array}{l}\cdot C{=}{=}{=}{=}N \\ \;| \qquad\quad | \\ \cdot C(OH)\cdot NH\end{array}$$

as this "carbonyl-ammonia" derivative might be expected to react like a hydrazone of the constitution



$$\begin{array}{l}\cdot C{:}N\cdot NH_2 \\ \;| \\ \cdot CO\end{array}.$$

Dr. Forster did not agree that two "phane" hydrazones are possible, being under the impression that according to Hantzsch and Werner the tetrahedral configuration of the nitrogen atom is supposed to apply only to those cases in which that element is multiple-linked with another atom, so that on adding hydrogen to diazocamphor the nitrogen valency-directions would distribute themselves in one plane.

*281. "The constituents of gelsemium." By Charles Watson Moore.

The material employed in this investigation consisted of the dried rhizome and roots of *Gelsemium sempervirens*, Aiton.

An alcoholic extract of the drug, when distilled in a current of steam, yielded a small quantity of an essential oil. The non-volatile constituents of the extract consisted of a brown resin insoluble in water, and material which remained dissolved in the cold aqueous liquid. The resin, which amounted to about 3·8 per cent. of the weight of the drug, yielded pentatriacontane; traces of emodin monomethyl ether; a phytosterol, $C_{27}H_{44}O$ (m. p. 136°; $[\alpha]_D$ −40·4°); a small amount of ipuranol, $C_{23}H_{38}O_2(OH)_2$; and a mixture of palmitic, stearic, oleic, and linolic acids. The portion of the alcoholic extract of the drug which was soluble in water contained scopoletin (a monomethyl ether of æsculetin), which was present in the free state, and also in the form of a glucoside, together with a quantity of sugar. It yielded, furthermore, three alkaloidal products, one of which, gelsemine, has been obtained in a pure, crystalline state, melting considerably higher than has hitherto been recorded (178° instead of 160°), and which has been shown to possess the formula $C_{20}H_{22}O_2N_2$. The other alkaloidal products, one of which corresponds with the so-called "gelseminine" of Thompson (*Jahresber.*, 1887, 2218) and Cushny (*Ber.*, 1893, **26**, 1725), were amorphous, and no crystalline derivatives could be obtained from them.

282. "Some phenolic derivatives of β-phenylethylamine." By George Barger and Arthur James Ewins.

In order to examine the relationship between physiological activity and chemical constitution the authors have prepared a number of bases related to and intermediate between *p*-hydroxyphenylethylamine and α-3 : 4-trihydroxy-β-phenylethylmethylamine (adrenaline), the two latter bases being chemically and physiologically similar. The following bases were described: *4-hydroxy-β-*m*-tolylethylamine*, $OH\cdot C_7H_6\cdot CH_2\cdot CH_2\cdot NH_2$, *3 : 4-dihydroxy-β-phenylethylamine*, $C_6H_3(OH)_2\cdot CH_2\cdot CH_2\cdot NH_2$, *2 : 3 : 4-trihydroxy-β-phenylethylamine*, $C_6H_2(OH)_3\cdot CH_2\cdot CH_2\cdot NH_2$, and *ω-amino-2 : 3 : 4-trihydroxyacetophenone*, $C_6H_2(OH)_3\cdot CO\cdot CH_2\cdot NH_2$.

A number of intermediate products employed in the syntheses were also described.

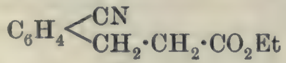
283. "Chloroamine reactions : methylenechloroamine."* By Charles Frederick Cross, Edward John Bevan, and William Bacon.

The authors have extended the observations of Raschig (*Ber.*, 1907, **40**, 4586) on monochloroamine, and have characterised the products of reaction of gelatin and various proteins with chlorine as chloroamine derivatives.

Methylenechloroamine, $CH_2:NCl$, is prepared by the interaction of monochloroamine and formaldehyde according to the equation $NH_2Cl + CH_2O = CH_2:NCl + H_2O$. The compound is readily obtained from hypochlorites (*N*/2-solution) by adding ammonium chloride and formaldehyde at the ordinary temperature. It crystallises from chloroform in large needles.

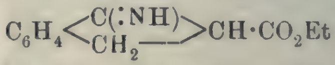
284. "The formation and reactions of imino-compounds. Part XIV. The formation of α-hydrindone and its derivatives." By Alec Duncan Mitchell and Jocelyn Field Thorpe.

It was shown that the compound prepared by Gabriel and Hausmann by the action of ethyl sodiomalonate on *o*-cyanobenzyl chloride, and described by them as ethyl *o*-cyano-β-phenylpropionate



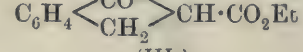
$$C_6H_4{<}\begin{matrix}CN\\ CH_2\cdot CH_2\cdot CO_2Et\end{matrix}$$

(I.)



$$C_6H_4{<}\begin{matrix}C(:NH)\\ CH_2\text{——}\end{matrix}{>}CH\cdot CO_2Et$$

(II.)



$$C_6H_4{<}\begin{matrix}CO-\\ CH_2\end{matrix}{>}CH\cdot CO_2Et$$

(III.)

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* This name is retained pending the final settlement of the constitution of the compound, in order to indicate its relation to chloroamine.

(I), is in reality ethyl 1-iminohydrindene-2-carboxylate (II), and that it is converted by hydrochloric acid into ethyl 1-hydrindone-2-carboxylate (III).

It was also shown that under suitable conditions the normal product of this condensation, namely, ethyl cyanobenzylmalonate, $CN\cdot C_6H_4\cdot CH_2\cdot CH(CO_2Et)_2$, can be prepared, and that on treatment with a small quantity of alcoholic sodium ethoxide it passes at once into ethyl carbonate and ethyl 1-iminohydrindene-2-carboxylate. In the same way the normal product of the condensation of ethyl sodioacetoacetate with *o*-cyanobenzyl chloride, namely, ethyl *o*-cyano-*α*-benzylacetoacetate, $CN\cdot C_6H_4\cdot CH_2\cdot CH(COMe)\cdot CO_2Et$, passes into ethyl acetate and ethyl 1-iminohydrindene-2-carboxylate, and when the sodium compound of ethyl cyanoacetate is used, the normal product, namely, ethyl *α*-*o*-dicyano-*β*-phenylpropionate, $CN\cdot C_6H_4\cdot CH_2\cdot CH(CN)\cdot CO_2Et$, passes under the same treatment into 1-imino-2-cyanohydrindene and ethyl carbonate. The products derived from these imino-compounds and from the corresponding ketones were described.

285. "Experiments on the synthesis of the terpenes. Part XIV. Synthesis of *d*- and *l*-Δ^5-*m*-menthenol(8), *dl*-Δ^4-*m*-menthenol(8), and their derivatives." By William Henry Perkin, jun.

The author described the conversion of 1-methyl*cyclo*hexan-3-ol-5-carboxylic acid (*Trans.*, 1909, **95**, 1889) into 1-methyl-Δ^5- and 1-methyl-Δ^4-*cyclo*hexen-3-carboxylic acids, the resolution of the former into its active modifications, and the synthesis, with the aid of these acids, of the menthenols and menthadienes mentioned in the title.

286. "Experiments on the synthesis of the terpenes. Part XV. Δ^3-*m*-Menthenol(8) and $\Delta^{3:8(9)}$-*m*-menthadiene." By Bernard Dunstan Wilkinson Luff and William Henry Perkin, jun.

The authors have discovered a new method by which 1-methyl-Δ^3-*cyclo*hexen-3-carboxylic acid may be prepared in quantity and converted into Δ^3-*m*-menthenol(8) and $\Delta^{3:8(9)}$-*m*-menthadiene. The physical properties of these substances were discussed in detail.

287. "The morphotropic relationships between silicon and carbon compounds of corresponding compositions." By George Jerusalem.

The suggestion made by Barlow and Pope as a result of their work on crystal structure, that carbon is the only element which is fundamentally quadrivalent, and that silicon and the other elements of group IV exhibit a fundamental valency of two, finds support in the fact that no properly authenticated case is known in which carbon and silicon are isomorphously replaceable. It is remarked that corresponding carbon and silicon compounds of high molecular symmetry and great molecular complexity might be expected to exhibit isomorphous or morphotropic relationships in spite of the difference in fundamental valency between the two elements. The author has determined the crystalline forms of tribenzylcarbinol, tribenzylmethyl chloride, tribenzylsilicol, triphenylcarbinol, and triphenylsilicol, and shows that a very close morphotropic relationship holds between the first three compounds; this furnishes the first recorded case of morphotropy between corresponding carbon and silicon compounds. It was further shown that the crystallographic data, just as is the case in the humite series of minerals, accord rather better with the view that the fundamental valencies of carbon and silicon are in the ratio of 4 to 2 than with that in which the same fundamental valency of 4 is assigned to both elements.

288. "The resolution of externally compensated pavine and *a*-bromocamphor-π-sulphonic acid." By William Jackson Pope and Charles Stanley Gibson.

A convenient method was described for preparing the dihydropapaverine, pavine, and a process was detailed for resolving it quantitatively into its optically active components by the use of *d*- and *l*-α-bromocamphor-π-sulphonic acid. The optically active pavines can be used in effecting the resolution of externally compensated α-bromocamphor-π-sulphonic acid.

289. "The rotatory powers of the salts of *d*- and *l*-camphor-β sulphonic acid with *d*- and *l*-pavine." By William Jackson Pope and Charles Stanley Gibson.

The salts of *d*- and *l*-pavine with *d*- and *l*-camphor-β-sulphonic acid have been prepared, and determinations made of the rotatory powers of these four salts for light of three different wave-lengths. The molecular rotatory powers of the basic and acidic ions can be calculated roughly from the observed values obtained from the above salts in dilute aqueous solution, but the discrepancies are too large to be attributed to experimental error.

290. "Externally compensated tetrahydroquinaldine (2-methyltetrahydroquinoline) and its optically active components." By William Jackson Pope and John Read.

Externally compensated tetrahydroquinaldine (2-methyltetrahydroquinoline) crystallises when its solution in light petroleum is cooled in liquid air, and on inoculating the pure substance at the ordinary temperature with the solid thus obtained, crystallisation occurs. A method was described for quantitatively resolving the base into its optically active components by the aid of *d*- and *l*-α-bromocamphor-π-sulphonic acid.

291. "The distillation of mixtures of enantiomorphously related substances." By William Charles Evans.

The mode in which a number of optically active mixtures of *d*- and *l*-camphor and of *d*- and *l*-2-methyltetrahydroquinoline behave on distillation under varying conditions has been studied. It was shown that in these cases the mixtures behave like single substances on distillation, and that no separation of the components can be effected by distillation under ordinary or diminished pressures.

292. "The tertiary acidic and alkyl derivatives of *d*-camphorimide." By William Charles Evans.

For the purpose of investigating the similarity of behaviour of phthalimide and *d*-camphorimide, a number of acidic and alkyl derivatives of the latter have been prepared by methods applicable to the former imide. The sodio-derivative of *d*-camphorimide, the corresponding bromo- and iodo-imides, and the tertiary alkyl compounds in which the iminic hydrogen atom of *d*-camphorimide is replaced by methyl, ethyl, benzyl, and *p*-nitrobenzyl, have been prepared and examined polarimetrically.

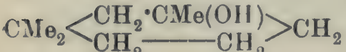
293. "The relation between the crystal structure and the chemical composition, constitution, and configuration of organic substances." By William Barlow and William Jackson Pope.

The authors have extended their previous work on this subject, and have applied the methods previously used to the study more particularly of the paraffins, olefines, and acetylenic hydrocarbons. Thus, homogeneous, close-packed assemblages have been constructed of spheres of atomic influence of two kinds, representing carbon and hydrogen and of the volume ratio, 4 : 1, present in the numerical proportions indicated by the general composition, C_nH_{2n+2}, of the paraffins; it is found that such an assemblage can be devised to correspond in composition with any paraffin, and that the geometrical partitioning of the assemblage yields a molecular unit in close accord with the generally accepted space configuration of the paraffins. Assemblages have also been constructed corresponding with the olefine and acetylenic hydrocarbons, and these exhibit geometrical features, which, it is claimed, represent the presence in the molecule of an ethylenic and acetylenic bond respectively. The relation existing between the acetylenic and aromatic hydrocarbons has also been examined in a similar manner.

It has also been shown that the geometrical results obtained are in accordance with the crystallographic data available for the halogen derivatives of the hydrocarbons.

294. "Synthesis of 1 : 1 : 3-trimethyl*cyclo*hexene (*cyclo*geraniolene)." By Arthur William Crossley and Charles Gilling.

1 : 1 : 3-*Trimethyl*cyclo*hexan-3-ol* has been prepared by the action of magnesium methyl iodide on 1 : 1-dimethyl*cyclo*hexan-3-one. The hydroxyl group of the alcohol is readily displaced by bromine, and from the resulting bromide, potassium hydroxide eliminates the elements of hydrogen bromide with production of isomeric forms of 1 : 1 : 3-trimethyl*cyclo*hexene, which have been proved to be identical with *cyclo*geraniolene.



$$CMe_2<\begin{matrix}CH_2\cdot CMe(OH)\\ CH_2\text{———}CH_2\end{matrix}>CH_2$$

295. "The viscosity and density of cæsium nitrate solutions." By Thomas Ralph Merton.

The densities and viscosities of solutions of cæsium nitrate in water have been determined at 0°, 10°, 18°, and 25° at concentrations varying from 0·02-*N* to saturation. The results are in agreement with the general principles discovered for other salt solutions. In the case of cæsium nitrate solutions the viscosity decreases with increasing concentration.

296. "The starch-iodine reaction." By William Harrison.

The author finds that in the formation of the blue iodide of starch the presence of iodides is not necessary. The blue colour is formed with pure iodine, but the depth is increased by the presence of any salt or weak acid. The gradual addition of alcohol changes the blue to violet, red, orange, and yellow, and the reverse change takes place on dilution with water. The same colour-change is produced by carefully heating the blue solution, and the reverse phenomena are observed on cooling.

This colour-change is analogous to the colour-change of colloidal gold solution, investigated by Zsigmondy, which changes from red to blue on adding salts.

The author succeeded in preparing a blue colloidal solution of iodine in water containing glycerol and no starch, but the colour only remained for a fraction of a second, the iodine being precipitated.

It was shown that all the iodine can be removed from starch iodide by washing with pure water, and the conclusion is drawn that the blue solution of iodine and starch is a colloidal solution of iodine, the starch acting as a protective colloid. It was further shown that the reactions of dextrins and starch celluloses can be obtained with starch under certain conditions, from which the conclusion is drawn that dextrins and starch celluloses are all different colloidal states of starch and not chemically different compounds.

297. "Aromatic hydroxy-sulphoxides."

By Maud Gazdar and Samuel Smiles.

The hydroxy-derivatives of aromatic sulphoxides are attacked by concentrated sulphuric acid, furnishing substances which exhibit a deep blue colour in that medium. As a preliminary to the investigation of the reaction, the sulphoxides of *p*-cresol, *o*- and *p*-chlorophenol and their derivatives have been examined.

298. "Binary mixtures of some liquefied gases."

By Bertram Dillon Steele and L. S. Bagster.

The authors have examined the variation of vapour pressure with temperature and with composition for mixtures of sulphur dioxide and hydrogen bromide, hydrogen sulphide and hydrogen bromide, and hydrogen sulphide and hydrogen iodide. Curves have been drawn for total and partial pressures through a considerable temperature range and also the pressure-composition curve of each pair at one temperature.

A specially constructed apparatus was employed, admitting of the removal of samples of both liquid and vapour for analysis.

The vapour-pressure curve of mixtures of sulphur dioxide and hydrogen bromide is of a well-known type, and is such as might be expected from the properties of the ingredients. In the case of hydrogen sulphide and hydrogen bromide, the curves show that a mixture exists of minimum vapour pressure or maximum boiling point. This is interesting in view of the fact that the solution is not an electrolytic conductor, and that neither ingredient forms associated molecules, whilst the hypothesis that the peculiarity is due to the formation of an additive compound is difficult to reconcile with the fact that hydrogen sulphide and hydrogen iodide give a different form of curve. This mixture affords a new instance of the somewhat rare phenomenon of an ideal binary mixture, that is, one to which Raoult's law applies over the whole range of concentration.

299. "Lead silicates in relation to pottery manufacture." Part II. By Sir Edward Thorpe and Charles Simmonds.

The authors have carried out some experiments showing the direction in which certain constituents of lead silicates influence the resistance of the silicates to attack by dilute acids. Alumina makes the compounds more stable; sodium oxide has the opposite effect; boron trioxide decreases the resistance in some cases, but has no such influence in others. Attention was also drawn to a recent publication by Beck, Löwe, and Stegmüller dealing with the same subject.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Armstrong, *Edward Frankland*. The simple carbohydrates and glucosides. pp. ix + 112. London 1910. (*Recd.* 17/10/10.)

From the Publishers: Messrs. Longmans, Green and Co.

Baker, *Richard T.*, and **Smith**, *Henry G.* A research on the pines of Australia. pp. xiv + 458. ill. Sydney 1910. (*Recd.* 25/10/10.)

From the Authors.

Leathes, *John Beresford*. The fats. pp. ix + 138. London 1910. (*Recd.* 17/10/10.)

From the Publishers: Messrs. Longmans, Green and Co.

Plimmer, *Robert Henry Aders*. Practical physiological chemistry. pp. viii + 270. ill. London 1910. (*Recd.* 17/10/10.)

From the Publishers: Messrs. Longmans, Green and Co.

Veley, *Victor Herbert*, and **Veley**, *Lilian J.* The micro-organism of faulty rum. pp. vii + 64. ill. London 1898. (*Recd.* 22/10/10.)
From the Authors.

II. *By Purchase.*

Cannizzaro, *Stanislao.* Sketch of a course of chemical philosophy. (Alembic Club Reprints, No. 18.) pp. iii + 55. Edinburgh 1910. (*Recd.* 28/10/10.)

Fourcroy, *Antoine François de.* Système des connaissances chimiques, et de leurs applications aux phénomènes de la nature et de l'art. 11 vols. Paris, Brumaire An IX. [1801]. (*Reference.*)

Groth, *Paul Heinrich.* Chemische Krystallographie. Teil III. Aliphatische und hydroaromatische. Kohlenstoffverbindungen. pp. iv + 804. ill. Leipzig 1910. (*Recd.* 28/10/10.)

Meyer, *Victor*, and **Jacobson**, *Paul.* Lehrbuch der organischen Chemie. 2nd edition. Vol. I. ii. 2. pp. 289 to 800. Leipzig 1910. (*Recd.* 28/10/10.)

Wedel, *Georg Wolffgang.* Specimen experimenti chimici novi, de sale volatili plantarum, quo demonstratur. Francofurti 1672. (*Reference.*)

III. *Pamphlets.*

Cannizzaro, *Stanislao.* La Scienza e la Scuola. (From the *Rassegna Contemporanea*, 1910, **3**.)

Dale, *H. H.*, and **Laidlaw**, *P. P.* The action of an active principle from apocynum. (From *Heart*, 1909, **1**.)

Dixon, *W. E.*, and **Halliburton**, *W. D.* The action of the choroid plexuses on the secretion of cerebro-spinal fluid. (From the *Proc. physiol. Soc.*, 1910; *J. Physiol.*, **40**.)

Dutoit, *Paul*, and **Duboux**, *Marcel.* Dosage physico-chimique des cendres du vin. (From the *J. Suisse Chim. Pharm.*, 1909, **47**.)

Emde, *Hermann.* Extraktion grosser Mengen spezifisch schwerer Flüssigkeiten mit geringen Mengen spezifisch leichter Lösungsmittel. (From the *Apoth. Zeit.*, 1909, **24**.)

Ewins, *A. J.* Some colour reactions of adrenine and allied bases. (From the *J. Physiol.*, 1910, **40**.)

Flavitzky, *F.* Application des lois d'eutéxie aux produits de fusion eutéctiques des silicates. (From the *Nat. Phil. Soc. Imp. Univ. Kazan*, 1909.)

Friend, *J. Newton.* The action of steam on iron. (From the *J. W. Scotland Iron and Steel Inst.*, 1910.)

Goris, *A.*, and **Crété**, *L.* Sur la nupharine. (From the *Bull. Sci. Pharm.*, 1910, **17**.)

Goris, *A.*, and **Fluteaux**, *G.* Analyse d'une Scammonée naturelle. (From the *Bull. Sci. Pharm.*, 1910, **17**.)

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, December 5th, 1910.

All persons who received grants in December, 1909, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Thursday, December 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal tar and allied industries.

At the next Ordinary Scientific Meeting on **Thursday,** November 17th, 1910, at **8.30** p.m., the following papers will be communicated:

"Preparation of secondary amines from carboxylic acids. Part I. Preparation of heptadecylaniline, pentadecylaniline, and tridecylaniline." By H. R. Le Sueur.

"The wet oxidation of metals. I. The rusting of iron." By B. Lambert and J. C. Thomson.

"The action of sodium amalgam on methylene ethers." By A. H. Salway.

"The homogeneous decomposition of ozone in the presence of oxygen and other gases." By D. L. Chapman and H. E. Jones.

"The addition of bromine to unsaturated compounds. Part II." By J. J. Sudborough and J. Thomas.

"The colour and constitution of diazonium salts. Part III. The diazo-derivatives of 2 : 7-naphthylenediamine." By G. T. Morgan and Miss F. M. G. Micklethwait.

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Issued 29/11/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 377.

THE BANQUET TO PAST PRESIDENTS.

The Banquet to the Past Presidents who have been Fellows for half a century :—

	Elected	President
Odling, William, M.A., M.B., Ph.D., F.R.S.	January 17, 1848	1873–1875
Roscoe, The Rt. Hon. Sir Henry Enfield, B.A., D.C.L., LL.D., Ph.D., M.D., D.Sc., F.R.S.	December 17, 1855.	1880–1882.
Crookes, Sir William, O.M., D.Sc., LL.D., F.R.S.	December 3, 1857	1887–1889.
Müller, Hugo, Ph.D., LL.D., D.Sc., F.R.S.	February 3, 1859	1885–1887.
Harcourt, Augustus George Vernon, M.A., D.Sc., D.C.L., LL.D., F.R.S.	February 3, 1859	1895–1897.

was held at the Savoy Hotel, on Friday, November 11th, 1910, Professor Harold B. Dixon, M.A., Ph.D., F.R.S., President, in the Chair.

The following Fellows and guests were present :—

Acland, Dr. T. Dyke.
Ampt, Mr. G.
Angel, Mr. A.
Armstrong, Dr. E. F.
Armstrong, Prof. H. E., F.R.S.
Astbury, Mr. J., K.C.
Baggallay, Mr. F. T.
Baker, Dr. H. B., F.R.S.
Baker, Mr. J. L.
Ball, Dr. W. C.
Barger, Dr. G.
Barlow, Mr. W., F.R.S.
Bayliss, Mr. R. T.
Beale, Mr. W. P., K.C., M.P.

Bedson, Prof. P. P.
Beer, Mr. J. J.
Beilby, Dr. G. T., F.R.S., *President, Institute of Chemistry.*
Berncastle, Mr. R.
Bevan, Mr. E. J.
Black, Mr. F. W., *Director of Navy Contracts.*
Boettinger, Mr. W. von.
Bone, Prof. W. A., F.R.S.
Bonney, Rev. Canon T. G., F.R.S., *President, British Association.*
Bradford, Dr. J. R., *Secretary, Royal Society.*
Browning, Prof. K. C.
Buckley, Rt. Hon. Lord Justice.
Buckmaster, Mr. C. A.
Buckmaster, Dr. G. A.
Burgess, Mr. W. T.
Burnham, Mr. J. C.
Butlin, Mr. H. T., *President, Royal College of Surgeons.*
Bywaters, Dr. H. W.
Cain, Dr. J. C., *Editor.*
Carr, Mr. S. E., *Assistant-Secretary.*
Chapman, Mr. A. C.
Chapman, Mr. D. L.
Chattaway, Dr. F. D., F.R.S.
Church, Sir A. H., K.C.V.O., F.R.S.
Clifford, Mr. F. W., *Librarian.*
Clowes, Prof. F.
Cohen, Prof. J. B.
Colman, Dr. H. G.
Connah, Mr. J.
Cooke, Mr. H.
Cooper, Mr. Albert.
Cowap, Mr. M. D.
Cowland, Mr. J. A.
Crichton-Browne, Sir J., *Treasurer, Royal Institution.*
Cripps, Mr. R. S.
Crookes, Mr. H.
Crookes, Sir William, O.M., F.R.S.
Cross, Mr. C. F.
Crossley, Prof. A. W., F.R.S., *Honorary Secretary.*
Dewar, Sir James, F.R.S.
Divers, Dr. E., F.R.S.
Dixon, Prof. H. B., F.R.S., *The President.*
Dixon, Mr. S. W.
Dixon, Dr. W. E.
Dobbie, Prof. J. J., F.R.S.
Dorée, Dr. C.
Drage, Dr. L.
Dunstan, Prof. W. R., F.R.S.
Durrans, Mr. T. H.
Dyer, Dr. B.
Dymond, Mr. T. S.
Edgar, Mr. C. B., *Deputy Chairman of Convocation, London University.*
Egerton, Mr. A. C. G.
Eyde, Herr Generaldirektor S.
Ferguson, Prof. J.
Findlay, Dr. A.
Forsey, Sir John, *Director of Nava Stores.*
Forster, Dr. M. O., F.R.S.
Foster, Prof. G. Carey, F.R.S.
Foucar, Mr. J. L.
Fowles, Mr. G.
Frampton, Sir George, R.A.
Frankland, Dr. E. P.
Frankland, Prof. P. F., F.R.S.
Freear, Mr. H. M.
Gardner, Mr. J. A.
Garton, Sir Richard.
Geikie, Sir Archibald, F.R.S., *President, Royal Society.*
Gilling, Mr. C.
Glazebrook, Dr. R. T., F.R.S., *Director, National Physical Laboratory.*
Gould, Sir F. Carruthers.
Greenaway, Mr. A. J., *Sub-Editor.*
Griffiths, Mr. T.
Groves, Mr. C. E., F.R.S.
Gwynne, Mr. H. A.
Haas, Dr. P.
Hall, Mr. A. D., F.R.S.
Haller, Prof. A., *President de la Société Chimique de France.*
Harcourt, Mr. A. G. V., F.R.S.
Hartley, Mr. H. B.
Hartog, Mr. P. J.
Hatch, Sir Ernest, Bart, M.P.
Haworth, Mr. W. N.
Heath, Mr. J. W.
Hennings, Dr. C. R.
Hill, Mr. C. A.
Hinchley, Mr. J. W.
Hinks, Mr. E.
Hodgkinson, Prof. W. R. E.
Holloway, Mr. G. T.
Hooper, Mr. E. G.
Howard, Mr. D.
Howard, Mr. T.
Hurtley, Dr. W. H.
Ionides, Mr. A. C.
Jackson, Prof. H.
Jeyes, Mr. S. H.
Jowett, Dr. H. A. D.
Kahn, Mr. H.
Keane, Dr. C. A.
Keith, Mr. S., *Master of the Skinners' Company.*
Kemp, Mr. W. J.
Keogh, Sir Alfred, *Rector, Imperial Coll. of Science and Technology.*
Kettle, Mr. J. D.
Kinch, Prof. E.
King, Mr. A. J.
Kipping, Prof. F. S., F.R.S.
Knowles, Mr. J.

Lankester, Sir E. Ray, K.C.B., F.R.S.
Larmor, Sir J., F.R.S., *Secretary, Royal Society.*
Lauder, Dr. A.
Legge, Dr. T. M.
Lessing, Dr. R.
Le Sueur, Dr. H. R.
Lewkowitsch, Dr. J.
Liversidge, Dr. A., F.R.S.
Lowry, Dr. T. M.
Lupton, Mr. S.
Macara, Mr. T.
Macdonald, Mr. George.
MacEwan, Mr. P.
McGowan, Dr. G.
McKenzie, Dr. A.
Macnab, Mr. W.
Martin, Mr. N. H.
Masson, Prof. D. O., F.R.S.
Mather, Rt. Hon. Sir W.
Meldola, Prof. R., F.R.S.
Merriman, Mr. R. W.
Messel, Dr. R.
Miers, Dr. H. A., F.R.S., *Principal, London University.*
Millard, Mr. E. J.
Miller, Mr. J. B.
Mond, Sir Alfred, Bart., M.P.
Mond, Mr. R. L.
Moody, Dr. G. T.
Morgan, Dr. G. T., *Honorary Secretary.*
Morley, Dr. H. F.
Mortimer, Mr. A.
Müller, Dr. H., F.R.S.
Murphy, Mr. P.
Nagel, Mr. D. H.
Northumberland, His Grace the Duke of, *President, Royal Institution.*
Odling. Prof. W., F.R.S.
Odling, Mr. M.
Orton, Prof. K. J. P.
Pearce, Mr. W., M.P.
Pedler, Sir Alexander, C.I.E., F.R.S.
Pendlebury, Mr. W. H.
Perkin, Prof. W. H., F.R.S.
Philip, Dr. J. C.
Pickering, Mr. S., F.R.S.
Pilcher, Mr. R. B., *Registrar, Institute of Chemistry.*
Plimmer, Mr. R. H. A.
Pope, Prof. W. J., F.R.S.
Power, Dr. F. B.
Poynting, Prof. J. H., F.R.S.
Pullar, Mr. R. D.
Ramsay, Sir William, K.C.B., F.R.S.
Redwood, Sir Boverton.
Reid, Mr. W. F., *President, Society of Chemical Industry.*
Reynolds, Prof. J. E., F.R.S.
Riley-Smith, Mr. H. H., *President, Institute of Brewing.*
Roberts, Mr. A. C.
Robertson, Dr. R.
Ross, Mr. J. C.
Rowett, Mr. J. O.
Rücker, Sir Arthur, F.R.S.
Rutherford, Prof. E., F.R.S.
Sach, Mr. C. F.
Salamon, Mr. A. G.
Samuel, Rt. Hon. H. L., M.P., *Postmaster-General.*
Scott, Dr. A., F.R.S., *Honorary Treasurer.*
Seaton, Dr. E. C.
Senier, Prof. A.
Senter, Dr. G.
Shaw, Mr. W. B.
Sidgwick, Dr. N. V.
Sinnett, Mr. A. P.
Smee, Mr. J. H., *Prime Warden of the Dyers' Company.*
Smith, Mr. H. W.
Smith, Mr. R. T.
Smithells, Prof. A., F.R.S.
Spielmann, Dr. P. E.
Spiller, Mr. J.
Spiller, Mr. W.
Strathcona, Rt. Hon. Lord, F.R.S., *Chancellor, University of Aberdeen.*
Struthers, Mr. R. de J. F.
Sullivan, Mr. J. F.
Swinburne, Mr. J., *President, Faraday Society.*
Teall, Dr. J. J. H., *Director of the Geological Survey.*
Tedder, Sir Arthur J.
Teed, Dr. F. L.
Thomas, Mr. R. N. G.
Thompson, Principal S. P., F.R.S.
Thomson, Prof. J. M., F.R.S.
Thomson, Mr. W.
Thorne, Dr. L. T.
Thorpe, Sir Edward, C.B., F.R.S.
Thorpe, Dr. J. F., F.R.S.
Tilden, Sir William A., F.R.S.
Townsend, Mr. F. H.
Townshend, Col. G. R.
Tutton, Dr. A. E. H., F.R.S.
Tyrer, Mr. Thomas.
Umney, Mr. J. C.
Van Essen, Mr. E. C.
Van Essen, Mr. Jacob.
Veley, Dr. V. H., F.R.S.
Voelcker, Mr. E. W., *President, Society of Public Analysts.*
Voelcker, Dr. J. A.
Wade, Dr. J.
Walden, Mr. A. F.
Wallach, Prof. Dr. O., *Präsident der Deutschen Chemischen Gesellschaft.*
Waller, Dr. A. D., F.R.S.
Walmsley, Dr. R. M.

Warner, Mr. C. H.
Watts, Prof. W. W., *President, Geological Society.*
Wayland, Mr. W. A.
West, Dr. Samuel H.
Williams, Mr. J. Arthur.
Williams, Prof. W. Carleton.
Wolfe-Barry, Sir J., F.R.S., *Chairman, Executive Committee of the City and Guilds of London Institute.*
Worsley, Mr. P. J.
Wynne, Prof. W. P., F.R.S.

The following toasts were proposed by the PRESIDENT:—

"HIS MOST GRACIOUS MAJESTY THE KING."

"THEIR MAJESTIES THE QUEEN AND QUEEN ALEXANDRA, HIS ROYAL HIGHNESS THE PRINCE OF WALES, AND THE OTHER MEMBERS OF THE ROYAL FAMILY."

"THE PAST PRESIDENTS."

The PRESIDENT: "Although I believe in the general truth of Thackeray's dictum that public speaking after dinner ought to be done—like the carving—by a skilful person at a side-table, still there are occasions when the heart itself must speak, however unskilful the utterance, for is it not true that

> "All hearts in love use their own tongues,
> And trust no agent"?

I know I utter something of that which is in the hearts of all our Fellows to-night when I offer to you, our honoured Past Presidents, in the name of the Chemical Society, our sincere and loving congratulations on your Jubilee as Fellows; and where I fail, as fail I must, to express the thoughts that are stirring in each of us—*conamur tenues grandia!*—I trust that failure will be put down to the difficulties of the task and to the imperfections of the instrument, and not to any lack of loyalty to my teachers, and not to any want of appreciation of their achievements or of gratitude for the friendships they have given me.

On the one occasion that forms a precedent for this celebration (curiously enough, it was Friday, November 11th, 1898), the distinguished President of that day was able, with the perfervid imagination of the Scot, to classify the past presidents into two divisions—the imperial and the merely regal—and so discussed them more or less *en bloc* and impersonally. Chemists, like other men, have their peculiarities. I have heard myself and my students branded as "anhydrous chemists"; I have heard another school maintain that water is "the only begetter" of chemical action, and I am told there are even chemists who look on wine when it is red and can see in that colour nothing but the evidence of *a quinonoid structure.* But I cannot find in our past presidents any common peculiarities by which I might label them, any natural groups into which I can divide them. At our last matriculation examination I set some question on the halogens, and received as an answer from a young lady: "Chlorine, bromine, and iodine are a very active set of chemicals, so active, indeed, that they are classed under the name of the *Hooligans*." Perhaps if our policy had been different towards those peris who have been knocking at the gate of our chemical paradise, a more imaginative president in my place would have had no difficulty in classifying or in attaching an appropriate label to the "very active set of chemicals" whose health we are toasting.

As it is, I must be personal and therefore discriminating in my praise, and you will readily understand that it is no easy matter to make discriminating and impartial remarks about, and in the presence of, one's seniors—especially when one was my university professor and examiner and another was my college tutor. I should be happy if I could reach the impartiality of the dying Irishman, who cried: "Bury me between my two wives, but—*wisht*, bhoys—push me *just a bit nearer to Biddy!*"

The Society is fortunate to contain on its roll of members twenty-four fellows of over fifty years' standing. To all of these we shall waft our greetings when we drink this toast. Of these Jubilee Fellows we have among us to-night—besides our past Presidents—Sir A. H. Church (elected 1856), George Carey Foster (elected 1856), P. J. Worsley (elected 1858), John Spiller (elected 1859), and Edward Divers (elected 1860). One name we had originally hoped to include among the Jubilee Past Presidents, that of the late W. J. Russell; but it was not to be. And another, G. D. Liveing (elected 1853) would have been among the living Presidents had his health been stronger.

I cannot read to you all (or even a selection from) the numerous friendly greetings sent by our colleagues from Europe and America. Luckily we have with us, in the President of the French Chemical Society, Professor Haller, and in the President of the German Chemical Society, Professor Wallach, representatives who can tell us with no uncertain voice what European science owes to the labours of our Jubilee Presidents.

But one short passage from a letter, headed "Washington," I will read to you:

"I am sure that I speak the feelings of all American chemists when I say that your guests more than deserve all the honour that can be shown them. Each one has made his permanent mark upon the history of chemical science, and will be remembered so long as chemistry is studied. Each one has been a source of inspiration to American chemists, and is as well known here as in his own home—perhaps better known if perspective counts for anything. When details vanish the great realities can be seen.

With regrets for my absence, and congratulations to the Society and its guests,

Yours sincerely,
FRANK WIGGLESWORTH CLARKE.

(1) RIGHT HON. SIR HENRY ROSCOE.

Fifty-five years ago Henry Enfield Roscoe was elected a Fellow of this Society, and read his first paper "On the Absorption of Chlorine by Water." The "sport," or, in modern terms, the "mutation," of a literary family, he will, I hope, tell us how the chemist in him was rough-hewn by Alexander Williamson, and how Bunsen shaped the ends—of his fingers. The early years of his manhood he spent with Bunsen at Heidelberg, designing and elaborating that beautiful apparatus for measuring the chemical intensity of light which has been the model for all subsequent investigators. At twenty-five, already known as a brilliant experimentalist, he was elected to the Chair of Chemistry at Manchester.

He came to Owens College in the darkest hour of her fortunes. Gifted with energy and courage, and above all with the power of seeing and drawing out what is good in others, Roscoe not only built up a great school, but he convinced his countrymen that a scientific education must be the corner-stone of our national industry. To be a successful professor in a struggling university, the professor must be—as Mrs. Ram said of Cæsar's wife—"all things to all men." I believe one of the secrets of Roscoe's success lay in his many-sidedness. The man who, in the intervals of teaching, tracked down the true vanadium, and in doing so gave order and meaning to the nitrogen group of elements, that man could turn aside from his researches to design and equip the largest laboratories of the time, could conceive and initiate a scheme which in its natural growth is within measurable distance of giving a university to every great city in the land.

Just twenty-four years ago it was my happy fortune to follow Roscoe at Owens, to breathe the atmosphere he had created, to know something of the devotion with which he was looked up to, to feel something of the stimulus which his presence radiated; and this I think I can truly say, that to his disciples the man was even more than his achievements. However much his students admire him as a researcher, however much they revere him as a teacher, it is his personality they most deeply cherish. The friend who stood by them through evil report and good report, the heart that warmed to them, and the head that studied and understood them, *these* make up the memory of Roscoe that will be his proudest monument, and their lifelong possession.

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(2) SIR WILLIAM CROOKES.

Of Sir William Crookes it might be said that somewhere in that fourth state of matter he was the first to explore he found the elixir vitæ, the secret of perpetual youth. It is close on sixty years ago since Hofmann's youthful assistant described to the Chemical Society a new class of bodies—the selenocyanides. Just on fifty years ago the same youth gave us the new element thallium. Again, after some dozen years filled with a variety of experiments, he set our brains whirling with the radiometer, and started with unabated enthusiasm to explore the "chemical vacuum" and to measure the heat of "molecular shock." This led to the spectroscopy of radiant matter and of phosphorescent bodies—work of such refinement that when, twenty years later, argon and afterwards helium were discovered, it was, of course, only natural that these refractory gases should be sent to Crookes' youthful eye to have their lines read and duly mapped. Five years ago the brain that had penetrated the witchery of the opal's colouring turned its searchlight on the diamond, and the mystery of its formation was made plain to all men. For fifty years the rare earths have been his happy hunting grounds; only yesterday that elusive metal, scandium, was rounded up by Crookes, separated from the impurities of its wild companions and made to mate with numerous respectable organic wives.

On Crookes as an experimental lecturer the mantle of Faraday has fallen. No one, since the master, has come so near the marvellous in experiment; no one has awakened the imagination with more inspiring touch.

I well remember hearing him lecture on the radiometer—I think in 1874: I ought to remember it, for it enabled me next day to pass my first viva voce examination in science—very much to the surprise of my friends. The examiner had not seen the radiometer, and I managed to get him to take such an interest in its proceedings that he forgot to plough me. Again, at Sheffield in 1879, I listened to the wonderful lecture on Radiant Matter. I thought the brilliancy of experiment could go no further; but since then I have been with Sir William in South Africa and seen the men of Kimberley—men who knew something about the subject—so carried away by his lecture on diamonds that they demanded that the lecture should be repeated, and, needless to say, this young man repeated it.

I know not what new experimental triumphs Sir William Crookes is contemplating; but this I know, he wears not only the order "For Merit," but a talisman with the motto, "Youth will be served."

(3) HUGO MÜLLER.

Among the many services which Hofmann rendered to English chemistry and to England, a high place must be claimed for his introduction of Hugo Müller to our former President, Warren de la Rue. Pupil of Erdmann at Leipzig, of Wöhler at Göttingen, and of Liebig at Munich, Hugo Müller came to London in 1854 to investigate the chemistry of Burmese naphtha in the laboratory of de la Rue and Co. The young chemist soon found work to his hand in that great factory which required the highest chemical skill and knowledge and the most laborious experiments to carry through; his success was marked by the adoption of many of the processes he discovered or improved. The electrotyping process and lithographic printing were by Müller's labours brought into practical use; for years everyone who fingered a banknote or stuck a postage stamp on a letter came unconsciously into personal contact with Hugo Müller's work. Engrossed as he was in these technical investigations, he yet found time to prosecute what is called pure chemistry—as ours and many other *Journals* bear witness. He was no specialist. He was equally expert in mineral analysis, crystallography, organic synthesis, and the nature of the electric discharge. And his interest in chemistry is as keen to-day as it ever was. I believe he cannot help it—his curiosity is insatiable.

It used to be said that no new discovery in chemistry was accepted on the word of the discoverer; that the experiment was sure to be repeated in some other laboratory, and either confirmed or disproved. I did not believe this until I knew Hugo Müller—now I do.

Men have been raising in London a temple to Science and Technology. If they should seek to enshrine in it a tutelary deity, they need not erect a double-headed Janus to look this way and that, but they might well model a statue from a living man who, looking straight before him, sees science and technology as one and indivisible: that man is our Past President, Hugo Müller.

(4) A. G. VERNON HARCOURT.

To Augustus George Vernon Harcourt my lifelong gratitude is due; for the fact that I am addressing you to-night from this honourable chair is entirely his doing. He found me an outcast from the classical fold, with no shred of scientific covering, and—rather ashamed. He took me to his laboratory and gave me a new interest in life and a career.

There was no care that Harcourt would not lavish on his pupils, no minutiæ of manipulation he would not repeat again and again to us. He noted all slovenliness with a watchful eye, and woe betide the wretch who spilt a drop of mercury! To this day I cannot pass a student's bench, where a speck of mercury lingers, without feeling in my pocket for a letter or a postcard, doubling one end of it like the bow of a boat, and scooping up the truant drop into my paper shovel. I commend the method—it is Harcourt's own; or did he learn it from Brodie or Faraday? Perhaps he will tell us to-night.

No one could be long in the old laboratory at Christ Church under Harcourt without being fascinated by those wonderful experiments of his on the velocity of the reaction between hydrogen peroxide and hydrogen iodide, which came as a revelation to the world of science. I shall never forget the first day I was privileged to assist in these experiments, and was set to watch the colourless liquid in its tall cylinder standing by the seconds-beating clock. If all went well, I was told, the blue colour would appear after an interval, I think, of two hours, fifteen minutes, and eleven seconds—and I must time its appearance to the tick of a second. As the afternoon wore on and the unexpected did not happen, I confess there were moments when I did not feel as

> "One in whom persuasion and belief
> Had ripened into faith."

But when the second came, and in the twinkling of an eye the blue colour spread through the liquid, I knew I had found the true scientific faith, and that my life was settled for me.

I have heard physicists declare that if they were transported to Mars they would be able to reconstruct there the unit of length from the wave-length of sodium light. Could not we also undertake, if this Society were dumped down on a planet, whose period of rotation and gravity differed from ours, to reconstruct the second, the minute, and the hour by the aid of hydrogen peroxide, hydrogen iodide, and of "Harcourt and Esson"?

I know many of Harcourt's old students, and I know they feel with me that, whatever advance towards truth and accuracy they may have achieved, they owe it to the teaching and example of him whose one aim has been to seek truth and ensue it.

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(5) WILLIAM ODLING.

At his own desire I speak last of the *doyen* of our science, to whom all younger chemists owe a debt of gratitude, though possibly some of us may be unconscious of the magnitude of that debt. We have only to turn up the text-books of fifty years ago and compare them with a certain "Manual of Chemistry—descriptive and theoretical," and with other books inspired by the New Chemistry, to see the marvellous change in the order, the meaning, and the correlation of chemical facts wrought by the "New Chemists'" *quorum pars magna fuit*—William Odling. His work profoundly influenced the views of his contemporaries. He himself has told us that in the earlier days of the Society, when he was a Secretary, papers were few but discussions were numerous; there is ample evidence to prove—if proof were wanting—that in those discussions no one put the new arguments more directly, more clearly, or more cogently than Odling. What impressed me most when I listened to him, a few years later, was his extraordinary clearness of vision. It was this power of seeing things as they really are that made him seem a prophet. Let me give three instances that fastened themselves on my memory. He saw at once the meaning of Andrews' experiments on ozone, and predicted the formula O_3, the formula proved by the later researches of Soret and of Brodie; he saw in hydrogen—not a volatile metal—but "the vanishing point of the hydrocarbons"; he saw in benzene—not a ring of carbon atoms in a plane—but two groups, each of three carbon atoms touching one another, one group resting on the other in space, nearly as Pope and Barlow teach to-day.

One other personal instance of prophetic vision I may mention in confidence: Odling examined me for honours, and (*how* he did it I don't know, for I knew next to nothing at the time) he gave me a first-class. Did he foresee this occasion? Perhaps he saw I had faith—and faith has been defined as "the substance of things hoped for, the evidence of things not seen."

Gentlemen, I know you all rejoice with me that we still have with us Odling, our interpreter and prophet, and we will take care that he shall not be without honour even in his own country. My Lords and Gentlemen,—I give you the health of our Past Presidents, The Right Hon. Sir Henry E. Roscoe, Sir William Crookes, Dr. Hugo Müller, Mr. A. G. Vernon Harcourt, and Professor William Odling."

[In Sir Henry E. Roscoe's absence, owing to indisposition, the President read the following reply.]

THE RIGHT HON. SIR HENRY E. ROSCOE: "Old age has its compensations amidst its many drawbacks. To the man of science one of the chief of these compensations is the kindly appreciation which is paid by the younger workers to those whose most active life-work is over. Such an appreciation the Chemical Society gives us to-night, and this it is which cheers one in our latter days, for, after all, it is the approbation and regard of one's fellow-workers in science which is the great reward.

Then comes memory. The recollection of the great men whom it has been one's good fortune to have known. The friendships which during the varied course of life one has made. The examples which such men have set before one; and even if the comparison of the great things which they have accomplished in science may far outshine one's own efforts, yet to have worked for the same end and to have won only a small prize is something to be grateful for.

To-night our thoughts naturally turn to the distinguished men who have been our Presidents—thirty-one in number. I have known them all with the exception of two (Aikin and Phillips). This is not the occasion nor the place to enlarge upon, or even to mention, the scientific work accomplished by our past Presidents. Indeed, any such account would be unfitting, seeing that you all are as well acquainted with that work as I am.

I may, however, be permitted to recall some few reminiscences of those with whom I have come into more intimate personal contact, and such recollections may be of interest, as to most of you many of our past Presidents are merely names with certain scientific labels attached to them.

Our first President—Thomas Graham (1841-43, 1845-47)—was my master. From his lips I first heard a connected account of our science. His lectures were clear and logical; his experimental illustrations carefully prepared and always successful. He was no orator, nor was he a striking personality, but his students recognised at once in him a master mind; his influence over them was great, and I, for one, shall always feel gratitude to him as my first great teacher.

Next to Graham, and perhaps before him in the influence exerted on myself, comes Williamson (1863-65, 1869-71), a man of a totally different race and character. Graham was a cool and dour Scot, and he was not a laboratory teacher. Williamson brought to London the enthusiasm of Paris and of Giessen, and was essentially a laboratory man. Every day he came down to his laboratory brimful of new ideas, and fired the young blood of his students with the notion that to be a chemist was the grandest thing in life. We were all of us as keen as mustard. We revelled in atomic motion; we thought no end of the four typical forms HCl, H_2O, H_3N, H_4C, and we were enamoured of the compound ethers, and even now, after fifty years, I could select by smell a sample of the seven carbon ethers from amongst a hundred other volatile compounds.

And now you must excuse me if I refer to a personal matter. Hitherto I have abstained from allusion to such matters, because I am speaking rather as an ex President and as a representative—at least, for the moment—of my four brethren whom you honour together with myself. I have often thought that it might have been more natural if, as a pupil and assistant of Williamson, I had gone to Paris instead of to Heidelberg. I might then have had a chance of continuing the line of research which Williamson inaugurated, and which Laurent, Gerhardt and Wurtz carried further, such, for example, as the discovery of the anhydrides—a discovery which, indeed, Williamson might have made had he not overlooked the existence of the compound which he afterwards termed chloride of othyl, now known as acetyl chloride. The name and fame of Bunsen were, however, too powerful an attraction to be resisted, and in Heidelberg I found myself in an entirely different atmosphere. Bunsen was not, like Williamson, a "theoretiker"; "one chemical fact is worth a host of theories," he used to say. So I became a follower of the great Heidelberg teacher, but only up to a certain point, for Williamson's influence made me an active disciple of what we then termed the new chemistry, in which Bunsen was not a leader.

Enthusiasm such as Williamson possessed is exhibited in many forms, and in every walk of life makes for success. No great teacher, no great worker in science, creates a school or does epoch-making work without this celestial fire. Williamson possessed it. He did not trouble himself much in grounding us in exact experimentation; I learned that afterwards from Bunsen. But he did more. He set us the example of what it is to be a "Forscher"—of a man in hot pursuit of the unknown. If he did not always gain his goal, his successes were great, and his consequent influence has been signal and lasting, not only on those who were fortunate enough to benefit from his example and to enjoy his friendship, but on the chemical world at large.

Perhaps of wider and more public renown was Hofmann (1861-63). He raised the tone of English opinion as to the position which chemistry must hold in the body politic. He gained a respect for chemical research amongst the higher classes of society in this country which had hitherto been but slightly acknowledged. And he was a born expositor in a language foreign to his own. I shall never forget a lecture delivered by him in the old lecture theatre in Faraday's laboratory down in the cellars of the Royal Institution on the early wonders of the coal-tar colour industry. It was, indeed, an incalculable loss to British chemistry when he was called back to the fatherland.

Then there comes before my mind's eye the face and figure of my dear friend Brodie (1859-61), a devoted worker in our science—a man whose heart was set upon promoting the cause of science at Oxford, and open to all progressive ideas, both scientific and educational.

Frankland (1871-73) was my predecessor at Owens. He is another of the *Dei majores* of our Presidents, for he, like Williamson—and, may I add, like Odling?—laid a foundation stone of Modern Chemistry.

Then follow the names—the respected, well-known names—of De la Rue (1867-68, 1879-80); Abel (1875-77); Gladstone (1877-79); Gilbert (1882-83); and last, but not least, Perkin (1883-85) and Russell (1889-91). These good friends are happy memories to all of us. They "their tasks have done, home have gone and ta'en their wages." All were remarkable in their several directions—all distinguished by their love of the science and by their devotion to the welfare of the Society.

Of our living ex-Presidents, and of our distinguished Chairman, I will not speak, except to say that they hold (and in this I am vain enough to place myself) in the esteem and regard of the Fellows a position equal to that which we all assign to the memory of those who have gone before. If Britain has held and continues to hold a high position in the science of chemistry—and who shall say, in looking back at our history, that her claim to the first place is unfounded?—I think it equally true that the names of our Presidents are those of good men and true who have worthily sustained the high position of representatives of British chemistry, and of whom the Society may well be proud.

As for the Society itself I have watched, from near and far—farther now than nearer, I am sorry to think— its rise and development for more than half a century, and you will agree with me when I say that at no former period has it shown more life and done more to advance our science than it is doing at the present moment.

For myself, I thank you all from the bottom of my heart for the honour you have done me. This will remain a red-letter day with me to the end of my life."

Sir William Crookes: "A retrospect—a long retrospect—ought to make me melancholy. But to-night, as I stand before you, I feel elated, not depressed. 'What more felicitie can fall to creature' than to realise the wild dreams of Youth. It has been accorded to me, for more than two generations, to devote myself amid happy surroundings to the magic work of original research in chemistry and the allied sciences. Work, I have always found, is its own exceeding great reward, and now to-night there is the added reward of your approval. But to reach one's Chemical Jubilee is not altogether a matter for joy-bells. When Bret Harte was felicitated on his fiftieth anniversary, he replied that he could understand a man shooting at his best friend from behind a hedge—but he could not understand how anyone could congratulate him on being fifty!

We can all recall Tyndall's invocation to the 'Scientific Use of the Imagination.' Tyndall was right. I may truly say that what success I have achieved in science I owe to imagination. It has helped me to track anomalies and residual phenomena, for these most frequently act as finger-posts along the high road of research, directing those who can interpret their symbols to bye-ways where lurk the mysteries. An inward prescience, a grasp of events before they occur, is indispensable to pure abstract research. But it must be used with judgment, for a preconceived idea is a dangerous travelling companion to a researcher. An eminent French chemist once warned his pupils that in scientific research, unless they were careful indeed, they would generally find what they looked for!

But not only are anomalies finger-posts—they sometimes perform more active functions. Frequently they are responsible for what Huxley called 'The great tragedy of science'—the slaying of a beautiful hypothesis by an ugly fact. I fear the radiometer has been guilty of more than one tragedy of this kind. But the whirligig of time brings its revenges, and my friend, Sir James Dewar, by his researches on high vacua and low temperature, now threatens to kill the radiometer!

I will take a brief glance backwards. My old master and dear friend Hofmann first started me on the road of research. About the year 1850 he proposed I should commence an investigation on the "Selenocyanides," using for this purpose some selenium I had extracted from seleniferous residues he had brought from Tilkerode. The result of this research was published in 1851 in the *Quarterly Journal of the Chemical Society.*

When first I entered the Royal College of Chemistry, Liebig was in the height of his fame; his 'Chemistry in its Application to Agriculture' would be a useful text-book to-day. In this book was first declared the importance—nay, the absolute necessity—of mineral matter and nitrogen to the well-being of the vegetal organism. Long and fierce were the controversies aroused by Liebig's views of the absorption of nitrogen from the air. Partisanship was keen; as a pupil of Hofmann, I naturally studied the subject in connexion with our food supply, and my interest continues to this day.

Our food depends on agriculture, and as the available wheat lands of the world inevitably contract, the economical cultivation of the soil becomes more and more a question of chemistry. At the Bristol meeting of the British Association in 1898, I reopened the nitrogen question, not with a view to produce what has been called a 'cosmic scare,' but to show how by the application of known physical and chemical reactions, the shortage of fixed nitrogen, and consequently of wheat, can be overcome.

One of the first analyses I performed at the College of Chemistry was that of the mineral cerite. The rare earths—my first, but not my only love—were then represented by ceria, lanthana, didymia, yttria, erbia, and terbia, and a specimen of yttria extracted from this cerite first gave me a key, thirty-three years later, to the citron band which then was haunting my laboratory.

Soon after Schrötter's discovery of amorphous phosphorus, the great professor came to the College of Chemistry to demonstrate to Hofmann the conversion of yellow phosphorus into the red variety. At that time I had acquired some skill in blowpipe manipulation, and was asked to help fit up the apparatus under Schrötter's directions.

The new art of photography early attracted my attention. I remember the excitement caused by the announcement of Daguerre's and Fox and Talbot's discoveries. I was working at photography in 1848, and not long after I had the privilege of being shown the Talbotype process by the master himself. One of my most highly prized relics is a copy of Talbot's 'Pencil of Nature.' In these snap-shot days it may be of interest to remember that portraiture was an affair of minutes, not seconds. I think there is one at least of my audience whom I victimised by a five-minute sitting in sunlight with his face chalked!

Niépce de St. Victor had discovered that uranium salts possessed the property of storing up light and giving it out in the dark, and in 1858 I took what was perhaps the first radium photograph in this country, by writing with solution of uranium nitrate on a card, insolating it, and then putting it face to face in the dark with a sheet of photographic paper; the image of the writing was reproduced on the paper. Also among my earliest recollections in photography is a photograph of the solar spectrum in its true natural colours by Edmund Becquerel. Those who had the advantage of examining Becquerel's coloured photographs in their early perfection will agree with me that they hardly fell short of the recent productions of Lippmann.

I took some of the earliest stereoscopic photographs for Wheatstone, and in 1852 I commenced work on the photography of solar and metallic spectra—work which has increasingly fascinated me to the present day.

I cannot say I was at the birth of the Daltonian atom; but it is not unlikely I shall see its deposition from the supreme place in chemical theory. The chemical elements long have been considered to be manufactured articles, to use a phrase of Sir John Herschel's, and as such they are subject to change and decay. They come into being and owe their stability to the outcome of a struggle for existence—a Darwinian development by chemical evolution. Just as in the biological world we have the survival of the fittest, so in the inorganic world we have the survival of the most stable or inert.

Hunting over some residues left after the preparation of selenium, I was confronted with my first anomaly—a bright green line in the spectrum. This started me on the thallium quest, and when determining the atomic weight of thallium I came to my second anomaly—the behaviour of bodies in a vacuum balance. Following this clue, I entered on the long research which culminated in the radiometer. In the high vacua obtained in these researches many electrical eccentricities were encountered, and in the long struggle to arrive at an explanation, behold the phenomena of Radiant Matter! The action of radiant matter, or, as we now say, of electrons, on the rare earths caused some of them to glow with a phosphorescent light; on submitting this light to the scrutiny of the spectroscope, another mystery—a bright citron-coloured line in the spectrum of the glowing solid—clamoured for explanation. Hence the yttrium and samarium investigation, and then the scandium work on which I am now sedulously engaged. Incidentally radiant matter opened the door to radioactivity, and nowadays radioactive bodies are bringing new elements to light with bewildering rapidity.

One of my closest friends in the early 'fifties was Robert Murray, an old man who in his young days had been assistant to Davy in his lectures at the Royal Institution. He was with Davy during his most eventful discoveries, and I have had descriptions of the isolation of potassium and sodium from an actual eye-witness.

I was early introduced to the Royal Institution by the Secretary, the Rev. John Barlow, my pupil at the Royal College of Chemistry. More than half a century of the Friday evening lectures means initiation into a whole cycle of wonders and mysteries wrested 'from Nature's inner shrine.' Interference of Light, by Young; Potassium and Sodium, by Davy; Liquefaction of Gases and Electricity from the Magnet, by Faraday; Low Temperature Work, by Dewar, etc., etc. The list of scientific victories is endless.

Among the early speculations I heard propounded by Faraday were those on the nature of electricity and the ultimate constitution of matter. In the highly rarefied regions of present-day speculation, our progress is so rapid as to take away one's breath! It seems no law is more certain than the Law of Change. A bit of radium that would go into a thimble has almost suddenly shaken our belief in the conservation of substance, the stability of the chemical elements, the undulatory theory of light, and the nature of electricity; has revived the dream of the alchemists and the preservation of perpetual youth, and has cast doubts on the very existence of matter itself! For physicists are beginning to say that in all probability there is no such thing as matter; that when we have caught and tamed the elusive atom, and have split it into 700 little bits, these residual particles will turn out to be nothing more than superposed layers of positive and negative electricity!

For many years I have been connected with a War Office Committee, one of whose duties it is to investigate methods of killing the greatest number of one's fellow-creatures in the shortest possible time. Researches of this character, super-Dreadnoughts, big guns, cordite, and lyddite, are the greatest of all preservers of peace.

What our country now most urgently requires are researchers. We have any number of practical men, but *brain-craft* is the master of *hand-craft*. England needs brain-craft. We want men who cultivate chemistry for its own sake without substratum of utilitarianism. Men whose discoveries, like that of phosphorus by Brandt, of the electric oxidation of nitrogen by Priestley, of potassium and sodium by Davy, of aniline by Unverdorben, of benzene by Faraday, and of chloroform by Soubeiran, seemed at the time never likely to be of the slightest use to anybody! With every man-slaying improvement our Committee elaborated, I said to myself, 'Another ten years' peace for my country!' It is the truest economy to spend money without stint to keep all such inquiries and appliances at their highest possible efficiency, knowing that in this way only can researchers be certain of securing the needful peace, without which no serious investigations can be carried to a successful conclusion.

Modern enterprise demands that as soon as a machine ceases to work well it is best to scrap it. After sixty years of research work, I begin to feel like a drone in a busy hive. But instead of ruthlessly consigning me to the scrap-heap, my kind friends have dined me, have said most flattering things about me, and have warmed my heart.

I must again thank you not only for the honour you have paid me to-night, but for listening to the expression of thoughts that are perhaps more of personal than general interest. My experience has been long and varied, and when I contemplate the work I have tried to do in the time that has been allotted me, I am afraid I must echo the sentiment of the wise man of old: 'When a man has done, then he beginneth; and when he leaveth off, then shall he be doubtful.'"

DR. HUGO MÜLLER: "My colleagues have already given expression to the reminiscences and sentiments which suggest themselves most prominently on this festive occasion, and I feel there is but little for me to add on my part.

I have been connected with this Society for over fifty years, for I was a constant attendant at the meetings from as early a date as 1854, when I was an Associate; later, in 1859, I was elected a Fellow.

It is eminently satisfactory to have been connected with so prosperous a concern, and still more so when one has had some small share in its development and administration.

Our Society, which was the first of its kind and became afterwards the prototype of many others, was then still in its infancy, and the slender volumes of the *Quarterly Journal* then published give some idea of the limited extent of its activity. Sometimes there was actually a dearth of material, and appeals were occasionally made to members to furnish some matter for communication at the meetings. However, in those days the meetings used to be taken up much more with the discussion of the papers than is the case nowadays, when chemical research has become so intensely specialised and consequently affords fewer opportunities for spontaneous discussion.

At that period the Society met at rooms in Cavendish Square connected with the premises of the Polytechnic in Regent Street.

Our Society made, however, such steady progress that by the time we were located in Burlington House it had already attained a large membership, and had grown more and more flourishing, and had become indeed of decided importance.

Probably it was mainly on this account that now some of the members became very anxious to introduce certain alterations in the character of the Society, with the object of giving the Fellowship a more professional status, and the consequent perturbation was a very serious matter for those who were in charge of affairs, and this state of things lasted for some years.

Ultimately it found vent in the formation of the Institute of Chemistry, the Society of Chemical Analysts, and the Society of Chemical Industry.

When at the present day we contemplate the varied activities of all these offsprings of our Society, we recognise the utter impossibility of comprehending them within the scope and aim of the parent society, and you will agree with me that it is a matter of congratulation that we have successfully resisted this agitation for a change in its constitution.

We may fairly consider the contents and size of our Transactions as a measure of the flourishing condition and great importance of our Society. It is also a satisfactory feature and well worth mentioning that the cost of our publications is still fairly balanced and within our income, for it is quite conceivable that at some future period the communication of papers will become so numerous and their publication so costly that the subscription of the Fellows may no longer suffice to cover the expenses, a contingency which at present is actually causing considerable trouble to one of our sister societies.

In conclusion, I beg to offer you my hearty thanks for the great honour you have done us in providing this splendid entertainment."

MR. A. G. VERNON HARCOURT: "Probably each one of us five regards the period in which he held office as a particularly important time; nor can I claim to be free from this impression. It was while I was a Secretary of the Society that we made place for the Artists, and left our apartment at the east end of old Burlington House to move into the less secluded but ampler quarters which we now occupy. On the day on which I became President, our Faraday Medal was presented by my predecessor, Dr. Armstrong, to Lord Rayleigh for the discovery of argon, resulting from his observation of the different densities of atmospheric and chemically-prepared nitrogen. In the separation and investigation of argon, Lord Rayleigh worked with Professor Ramsay, and the award of the medal was immediately followed by the announcement by Professor Ramsay of another gaseous element, helium, which, like argon, had been mistaken for nitrogen, and which had been discovered as a constituent of the atmosphere of the sun before it had been recognised on earth and found to be a constituent of our own atmosphere. The actual measurements of the spectrum of the new element and the identification of the gas from cléveite with the helium of the sun were then communicated to the Society by one of our Past Presidents, Sir William Crookes. Two years later, when Professor Ramsay had made a complete investigation of the mineral sources and properties of helium, I had the pleasure of presenting to him the Longstaff Medal.

Many other important communications were made to the Society during those two years, and we listened to the memoirs of three great men of science—Helmholtz, Lothar Meyer, and Pasteur. But that was more than thirteen years ago, and the thirteen years between the ages of sixty-three and seventy-six make a great difference to a man; and I must hope that our proceedings at that time are better retained in the memories of many of my audience than they are in my own.

There used to be a yearly cricket match, in which the players were Chelsea Pensioners, all old men, if not all over seventy, with the further disadvantage, which is not shared by your guests to-night, that half of them had only one arm, and the other half only one leg. It would be unjust to those who arranged the match and gave dinner to the players to put among their motives the fun of trotting the old boys out, or to doubt that they watched their efforts with kindly and uncritical eyes. Fortunately your veterans are not called upon to do anything of an active kind—not even to show manipulative skill—but only to acknowledge and thank you for the kind feeling and the wish to do them honour which have brought us here.

One cannot help putting to oneself the question: What have we done more than other Past Presidents of the Society to gain this honour? All right-minded men, who are free from severe pain or grief, enjoy life, and wish it to be prolonged. What others cherish and desire, we have achieved; nor, even at this culmination of our careers, do we ask now to be dismissed, but appear before you—to use Charles Lamb's phrase—as 'jolly candidates' for the second decade of the century.

It is said that Faraday as age advanced upon him found that his memory was failing, and that he must choose for investigation some wholly new subject, not requiring any recollection of previous work; and it is said further that to this limitation was due the discovery of diamagnetism. Ordinarily, such failure of memory has a less satisfactory result. An old man may retain his interest in the parts of science which most attracted him, but of what he reads little remains a few days later, and he gradually desists from that study of the current literature of science which to younger men is both an enjoyment and a necessary condition of useful work. I have an intimate and rather painful knowledge of one such case; but I may be generalising too hastily, for some of your old Past

Presidents are able to bring their long experience to bear upon the present, and to make shrewd and illuminating remarks upon the recent progress of chemistry. I, unfortunately, am only conscious that our science is advancing and changing with bewildering speed.

Conjectural formulæ, presumably well founded, contend with one another. I remember that the constitution of camphor was being settled when I was President, and that rival formulæ received vigorous support. In the explanation of chemical changes and of the structure of molecules, human ingenuity is more than a match for the complexity of nature. When, as must happen occasionally, a hypothesis is punctured by collision with some hard fact, it is at once neatly patched with another hypothesis. The atoms in which we believed, and the molecules which passed into solution entire or flitted about as gases, are now broken up into much smaller pieces. Chemists discovered the formation of ions, independently of an electric current, and the Physicists presented them with electrons. Elements gradually disappear, at fixed rates, in a certain number of years or even of days. Our foundations are shaken; and one may fear that fifty years hence, when some of our youngest Fellows will be Past Presidents enjoying their jubilee, the very hexagon may have lost its place of honour in chemical literature.

In this connexion I will venture to refer to a question of some public importance with which chemists have to deal, namely, the influence of the rapid growth of Chemistry, and especially of chemical views—which my good friend and master, Sir B. Brodie, called 'Ideal Chemistry'—upon the teaching of the science as a part of general education.

We shall most of us agree that after reading, writing, and arithmetic, and next in value to moral instruction, comes a knowledge of the general results of scientific inquiry and some insight into the methods by which such knowledge has been gained. What parts of chemistry should find a place in such a scheme? Two limitations may be suggested, first, to facts and generalisations which are absolutely established, and secondly, to familiar substances, the chemistry of common life. The enthusiastic chemist, who aims at keeping himself abreast of his subject, and to whom the teaching of chemistry, not only to future chemists, but as a part of general education, is rightly entrusted, must find it more and more difficult to make the necessary 'cuts.' He has to bear in mind that however valuable the latest hypotheses may be for the progress of chemistry or for the advanced student who has an examination to pass, they must not be put before those who are only studying science as a part of education and chemistry as a part of science, and who may be misled into thinking that they are well forward in chemistry because they have gained some of the latest lights.

We older chemists are often told that the amount of chemistry which has to be learnt for examinations now, is far greater than was required in our time. I do not believe it. The average of industry and of memory, the two great factors in the storage of knowledge, does not change much in fifty or sixty years. The things taught are different. Much is added, and therefore much has to be omitted. Fifty years hence there will be the same disposition of those who are in the front to speak scornfully of what is being taught now.

This line of reflection brings us to the oppressive thought, which must not be too much indulged, of the littleness of our steps forward in science compared with the immensity of what there is to be known.

'We have not gained a real height,
Nor are we nearer to the light,
Because the scale is infinite.'

I must not end this evening on so sad a note. The same fact may be looked at quite otherwise. It is the successful, or even the unsuccessful, pursuit of truth which gives happiness to each generation of scientific men, and not the value of the truth itself—the energy, the doing, not the thing done. If a time could arrive when all was known, when there could not be a new investigation or experiment, our keenest pleasure would be at an end. We may therefore feel happy in the thought of how much is still unknown. The questioning of nature is likely to last as long as the generations of mankind.

It only remains for me, in conclusion, to thank you, gentlemen, and especially my friend our President and the members of the Council, for my share in the honour and the pleasure which you have bestowed upon your old Past Presidents."

Professor WILLIAM ODLING: "From my point of view, the most important thing I have to say is to express to you my appreciation and deep gratitude of the honour you have done me. This is the third occasion on which I have been entertained publicly at the hands of the Society. In this respect, I feel I cannot express myself in words better than those you have already heard read from the letter sent by Sir Henry Roscoe.

It is a great gratification to us seniors to feel we are not altogether forgotten. We greatly appreciate the kind feeling which still attaches to us in memory of old days. If it only depended upon myself, I think I could go on for a very long time talking of the old days, but it is a question whether it would interest some of you. On a previous occasion—twelve years ago—I was honoured in a similar manner at an entertainment which was presided over by my successor—my almost immediate successor at the Royal Institution—Sir James Dewar, who has so worthily filled the position he now holds, and who has achieved for himself a world-wide reputation. I was at that time associated with five of my very oldest friends. At the present time I am associated with others of almost as long standing, and I will venture to express a word or two with regard to each of them, not in their abstract but in their personal relations with me. I can only express regret that their number is now four. What pleasure it would have given us to have included in our numbers Perkin and Russell. Both were distinguished as chemists —one of them as a pioneer—and both of them were estimable and lovable in character, and devoted to the interests of the Society. With regard to Roscoe, he was seven years my junior as a Fellow of the Society, and seven years my junior as a President.

He always had a very youthful appearance, and I can at this moment remember making his acquaintance in Williamson's laboratory. Williamson introduced Roscoe to me as one of his most promising pupils. In expressing my appreciation of the great personal attractiveness of Williamson, I must say that those who have only known him in later years can have no conception of the magic of his influence on those who were thrown into association with him.

My acquaintance with Crookes has been hardly so long as with Roscoe, but, at any rate, it has been equally close; more close, in fact, for a number of years. I am delighted, on an occasion such as this, to be associated with Crookes as one of our guests this evening. He is as active as ever. Forty years ago, when I was a member of the Council of the Royal Society, I had a paper sent to me, and I had to say whether it was meritorious enough to be published. It was on the atomic weight of thallium. I will not say what was the nature of my report, beyond that the paper was published. But I would venture to say that the publication of that paper marked an era in this country in the determination of atomic weights—I can almost say, in any country. Even with regard to the work of my old friend Stas, it was its equal, if not superior. I do not know how many of you will remember Stas. He was affectionate and effusive in his demonstrations. I met him at the door of the International Exhibition of 1862, and, knowing his effusiveness, I held back a little. But in a minute or so he had laid hold of me, put his arms around my neck, and kissed me on the cheek, to the consternation of a burly policeman standing near.

As a lecturer on organic chemistry, it is surprising to me to find how constantly I have to refer to the researches of Dr. Müller. We esteem him for his energy, for his contributions to science, and, above all, for his personality and amiable character, which has endeared him to all of us. I have an additional obligation, for it was through him that I became known to and associated with Kekulé, a name always to be mentioned with honour in the study of organic chemistry.

Harcourt and I have been associated as teachers at the University, and although not always seeing a thing from the same point of view, we have in the main agreed, always feeling that there existed a pleasant relationship one to another. To Harcourt we are all indebted for his history of the formation of the University Museum, an institution which has done so much for the advancement of science at Oxford. It has done great things for the study, not only of chemistry, but of natural science generally at Oxford, and this brings me to say a word or two about the association of Oxford with the Chemical Society. Fifth in order of the series of Presidents was Dr. Daubeny, who was at that time professor, and whose memory is still dear to Oxford men and is embodied in the Daubeny laboratory. He was President of the Chemical Society, and among the twenty-seven of his successors we find four other Oxford teachers. He was followed by Brodie and myself, Harcourt, and then by our present President, who, before being translated to Manchester, was the Millard lecturer at Oxford. Out of thirty-two Presidents, Oxford has contributed five, Edinburgh two, Dublin one, and Cambridge also two, although without being very prophetic we can conceive that number must be added to before long.

I should have liked to speak about my associations with all the Presidents of the Chemical Society—at any rate, I should have liked to speak of the first four or five.

Richard Phillips was one of the Presidents with whom it was my good fortune to become intimately associated, and by and by he became the editor of the *Philosophical Magazine.* He was an able critic, a great conversationalist, and a newsmonger, and from his addiction to personal joking he was spoken of (independently of his position as editor) as "Phil. Mag." I was in 1851 appointed tutor at Guy's Hospital, where I was brought into association with the second President of the Society.

A word or two about myself as one of the guests on this occasion. I became Fellow in 1848, and was therefore practically one of the founders of the Society; I acted as Secretary, and filled the position of third President, in order of series, to my old tutor, Arthur Aikin. I was afterwards translated to St. Bartholomew's Hospital, and from there to the Royal Institution, where I met Faraday, of whom it is impossible to speak without regret and veneration. Then I went to Oxford, where I met Brodie. I am still attached to Oxford, and have had the advantage, the very great advantage of having had, both before and since my appointment, a succession of assistants of whom any professor of chemistry might be proud. First was Körner, now of Milan, whose name is a household word among us, and others who have, one after the other, achieved the distinctions of being made Fellows of the Royal Society, namely, Dupré, Dunstan, Hartley, Veley, and Marsh, whom, I am glad to say, is still with me. I wish to express my deep indebtedness to all of these, and to my faithful assistants, Fisher and Watts, who are with me still. I am delighted to be here among my juniors to-night, and to feel myself at home."

"THE FOREIGN MEMBERS."

Sir **EDWARD THORPE**: "It is a saying no less true than trite that 'Science knows no geographical limitations.' She recognises no national frontiers. Science is as much the common property and heritage of mankind as is the all pervading air we breathe and which we all alike share. No nation or people has any exclusive property in science, any more than it has in the universal ether or in the forces of nature. This fact is recognised in the almost universal practice of scientific societies to welcome within their ranks workers in science of every nationality. The men of science constitute one large brotherhood; they may speak a variety of tongues; they may owe allegiance to many rulers, but they are all engaged in a common cause, and they work and strive together in honourable rivalry with a unity of aim, and that is to discover and elucidate scientific truth, and to apply the knowledge of that truth to the amelioration of our common humanity. We Britishers are proverbially a sporting people. We truly love a race of any kind: competition and the struggle for supremacy are as breath to our nostrils. It is a national characteristic and pervades every department of our national activity. But your true sportsman recognises and acclaims merit wherever he meets with it. If he wins he wears his laurels modestly; if he loses, he takes his beating manfully, and offers his congratulations to the better man. I believe we carry this characteristic into the grand international struggle in which, as men of science, we are engaged. The good will which the Chemical Society bears to its foreign colleagues is reflected in the long list of its honorary and foreign members. From the earliest days of its inception, the Society has extended the hand of good fellowship to our foreign colleagues, and we are proud that we number some of the most eminent of them among our Fellows. We believe they appreciate the spirit in which our invitation has been extended to them. We, in our turn, are grateful to them for the honour and the distinction they have conferred upon us. It is with a feeling of deep gratitude that I invite you to drink to their health, and that I ask you to allow me to associate with the toast the names of Professor Haller and Professor Wallach. These gentlemen, the one

President of the Chemical Society of France, the other President of the Chemical Society of Germany, are charged with messages of felicitation to the veterans whom we are assembled here to honour. On this account you will extend them your warmest greeting. You will recognise that each of them represents a nation which has played a long and honourable part in the science to which we are all attached, and which it is our privilege to serve."

PROFESSOR ALBIN HALLER: " L'hommage que vous rendez ce soir à vos jubilaires procède, toutes proportions gardées, du même sentiment que celui très touchant, que vous avez rendu au cours de cet été, au noble souverain qui a présidé aux destinées de l'empire avec tant de tact, tant d'autorité et tant de bonheur.

Ce sentiment est fait d'affectueuse déférence et de sincère gratitude envers les hommes qui, à des titres divers, et quelles que soient leurs conditions sociales, ont honoré l'humanité et ont jeté quelque éclat sur votre pays.

De même que la France s'est associée sincèrement et de tout son cœur à votre deuil national, de même la Société chimique de Paris a tenu à apporter aux savants vénérés, dont vous célébrez aujourd'hui la brillante carrière, un témoignage de profonde sympathie et de cordiale reconnaissance pour les services qu'ils ont rendus à la science et à leur patrie.

L'estime que vous m'avez témoignée, en me conférant le titre tant envié de Membre honoraire de votre Société, me vaut, en ce jour, la joie très douce d'assister à cette réunion et de pouvoir vous exprimer la satisfaction que j'éprouve d'être l'interprète de tous nos collègues de France envers les héros de cette fête.

La première en date, de toutes les sociétés de Chimie qui existent de par le monde, votre Société a servi de modèle à toutes celles qui sont écloses à sa suite.

Son développement est intimement lié à l'évolution de la Chimie même pendant la seconde moitié du siècle dernier, et son influence, sa prospérité, sont dues autant aux hommes marquants et dévoués qui l'ont présidée qu'aux nobles et fortes traditions qu'ils ont instaurées.

Comme vos aînés vous vous êtes toujours attachés à confier sa direction aux plus vaillants et aux plus qualifiés de vos émules.

En toute circonstance, à toute époque, vous ne manquez pas de vous inspirer de votre noble adage:

'The right man in the right place.'

Il serait téméraire de vouloir énumérer, après votre très honorable Président, M. le Professeur Dixon, tout ce que la science doit au dévouement, à l'esprit d'invention et à l'habileté expérimentale des maîtres sympathiques auxquels vous rendez hommage ce soir.

Tous, en leur temps, ont tracé plus ou moins profondément leur sillon et ont donné l'exemple d'un labeur fécond et désintéressé, tout en assurant la prospérité de votre Société.

Tous les cinq ont marqué les multiples incursions qu'ils ont faites dans le domaine de la science, par des découvertes inattendues, des observations ingénieuses et des aperçus pleins de hardiesse et d'originalité.

Sans doute, l'apport constant de clartés et de faits nouveaux a souvent pour effet de dissimuler sous le voile de l'anonymat les vérités établies par nos devanciers, tant elles paraissent simples et évidentes aux esprits superficiels. Elles n'en font pas moins partie de notre patrimoine intellectuel et le nom de leurs auteurs restant à jamais gravé dans les Annales de la Science, apparaîtra au grand jour chaque fois qu'il se trouvera un chercheur désireux de remonter à l'origine de nos connaissances et d'en faire l'inventaire.

A l'heure présente, les noms de M. le Professeur Odling, de Sir Henry Roscoe, de Sir William Crookes, du Dr. Hugo Muller, et du Dr. A. G. Vernon Harcourt éveillent en nous un sentiment de vive reconnaissance pour l'œuvre originale et savante dont ils ont doté la science et pour le bel exemple de labeur qu'ils nous ont donné.

En sa qualité de fille aînée de votre Compagnie, la Société Chimique de France m'a chargé de traduire les sentiments de haute estime et de respectueuse sympathie qu'elle éprouve envers les cinq Jubilaires en leur décernant à chacun sa médaille à l'effigie de notre grand Lavoisier.

A l'hommage qu'elle rend ainsi à leur profond savoir, s'ajoutent ses vœux les plus ardents et les plus sincères pour qu'ils contribuent pendant de longues années encore au progrès de votre Société et à la notoriété scientifique de la nation britannique."

Professor Dr. OTTO WALLACH: "I wish to tender my most sincere and hearty thanks for the kindly feeling which has prompted my invitation for this auspicious occasion, and also for the friendly sentiments which have been expressed towards the foreign members of this Society.

At the present time it is not easy for a German professor to leave his work in order to undertake a long journey. I should, however, have been extremely sorry to miss the opportunity of personally stating how highly I prize my honorary membership of the Chemical Society.

Much less would I, as a member of the sister German Society, desire to refrain from conveying to the Past Presidents of the Chemical Society an expression of the veneration and esteem in which they are held by German chemists.

If I may be permitted to add a few words more, I will ask to be

allowed to speak in my own language. You will probably understand my German better than my English, and I also believe that what one desires to say can better be expressed in one's mother tongue.

Wenn wir, sehr geehrte Herrn, uns zu vergegenwärtigen suchen, welche Chemiker früher in England die Entwickelung unserer Wissenschaft in besonderer Weise gefördert haben, so werden wir in Erstaunen gesetzt eine wie grosse Anzahl von Persönlichkeiten daran betheiligt war. Vor unserem geistigen Auge ziehen da ausgezeichnete Männer wie ein glänzender Triumphzug vorüber, der mit den ersten Anfänge der Chemie beginnt und sich bis zum heutigen Tage erstreckt.

An der Spitze dieses imposanten Zuges schreitet die grosse Forschergestalt *Robert Boyle's*. Ihm folgen andere Koryphäen der Wissenschaft in ununterbrochener Kette. Als in den meisten heutigen Kulturländern "Chemie" noch ein unbekannter Begriff war, entdeckte *Priestley* den Sauerstoff und lehrte zugleich als erster, wie man überhaupt mit Gasen operieren muss. Mit den Gasen, von denen man früher manche für nicht coërcibel hielt, die man jetzt nach den wundervollen Methoden von Prof. *Dewar* leicht in flüssigen Zustand zwingt. Welche unerwartete Erweiterung and Weiterentwickelung die Kenntniss der Luftarten in unseren Tagen durch die ewig denkwürdigen Untersuchungen von *Lord Rayleigh* und *Sir W. Ramsay* erfahren hat, bedarf keines Hinweises. Betrachten wir weiter die Entfaltung unseres Zuges, so sehen wir nach Priestley *Cavendish* erscheinen und vor allen ragt *Dalton* hervor, der mit der Atomtheorie die Basis für die theoretische Chemie schuf. Mit Dalton kommt *Humphry Davy*. Wenn wir heut das halbhundertjährige Fellow-Jubiläum unseres Past Presidents feiern, so dürfen wir dabei wohl der Thatsache gedenken, dass in diese Tage auch ein Centenar-Jubiläum fällt. Denn grade 100 Jahr sind es, dass—im November 1810—H. Davy vor der Royal Society jene berühmte Abhandlung verlas, in der er die elementare Natur des Chlor aussprach. Wenige Jahre vorher hatte er die Welt durch Entdeckung der Alkali-metalle in Staunen gesetzt. Aber Davy hat jener Zeit noch etwas anderes entdeckt, wofür ihm die wissenschaftlische Welt dankt: er hat das Talent *M. Faraday's* entdeckt und der Chemie zugeführt.

Die Anwendung der Faraday'schen electrolytischen Gesetze gehört heut zu unserem unentbehrlichsten chemischen Handwerkszeug. Neben diesen und vielen anderen, fand Faraday bekanntlich auch das Benzol auf, die Muttersubstanz des Anilins, aus dem der verehrungswürdige *W. H. Perkin* sen., dem wir—ebenso wie seinen Söhnen—so viele wichtige Arbeiten auf dem Gebiet der organischen Chemie verdanken, den ersten technisch brauchbaren Anilinfarbstoff herstellte.

Bei Erwähnung des Benzols gedenken wir weiter *Couper's*, der sich mit *Kekulé* in den Ruhm theilt, die Idee der Atomverkettung concipiert zu haben. Die Nennung von Kekulé's Namen bringt uns wiederum in die Erinnerung, dass Kekulé hier in London Assistent von *Stenhouse* war. Kekulé hat, wie so viele deutsche Chemiker mit, vor und nach ihm—wie die *A. W. Hofmann*, *Schorlemmer*, *Dittmar* u. a. —in diesem gastlichsten Land der Welt auch Gastfreundschaft genossen. Den Dank den wir England dafür schulden wird man in Deutschland immer lebendig finden. Wie könnte ich in dieser kurzen Stunde sie nun aber weiter alle hier aufzählen, die Träger klangvoller Namen, die *Graham*, *Williamson*, *Frankland* u. a. die wir in dem Theil des Triumphzuges englischer Wissenschaft finden, der an vergangene Zeiten mahnt! Der Blick in die Vergangenheit erweckt sonst leicht das Gefühl der Trauer, über das, was wir nicht mehr besitzen. Aber davor sind wir heut geschützt. Denn wir haben die grosse Freude und das grosse Glück in den Männern, die zu feiern wir zusammengekommen sind, Repräsentanten einer der glänzendsten älteren Epoche der Chemie noch frisch und lebenskräftig unter uns zu wissen und ihnen den Dank dafür darbringen zu können, dass sie durch ihre Arbeit eine Saat ausgestreut haben, deren reife Frucht die junge Generation der Chemiker heut erndtet.

War es doch Prof. *William Odling*, der bedeutsamen Antheil an der Ausgestaltung der Typentheorie genommen hat. Er hat ferner schon 1857 von dem "Ersetzungswerth" von Wasserstoff und Sauerstoff gesprochen und die Werthigkeitstheorie vorbereitet.

Sir *Henry Roscoe*, dessen Arbeiten über die Isolierung und über die Eigenschaften des Vanadium's für immer ein Vorbild exacter chemischer Forschung bleiben werden, hat in seinen mit R. Bunsen gemeinsam ausgeführten photochemischen Untersuchungen die Grundlage für die heutige Photochemie mit geschaffen.

Sir *William Crookes* hat nicht nur durch Entdeckung des Thallium's die Chemie bereichert. Seinem genialen Forscherblick offenbarte sich zuerst die "strahlende Materie," deren Erscheinung in der modernen Physik eine so hervorragende Rolle spielt.

Wenn, weiter, heut die katalytischen Erscheinungen wieder ganz besonders in den Vordergrund des chemischen Interesses gerückt sind, so geziemt es sich der Thatsache zu gedenken, dass Dr. *Hugo Müller* 1862 die katalytische Wirkung des Jod's bei Halogenisierungs-Processen aufgefunden hat.

Die Verdienste Dr. *Vernon Harcourt's* um die analytische und angewandte Chemie sind in England bekannt.

Wir sehen: die hochverehrten Past Presidents sind nicht nur Leiter der Chemical Society gewesen, sondern auch Leiter auf den Pfaden der Wissenschaft. Damit haben sie Schule gemacht und daher bis zur heutigen Stunde nach beiden Richtungen hin stets würdige Nachfolger

gefunden. Die Chemical Society hat unter ihren trefflichen Praesidenten in der Chemischen Welt immer wachsende Bedeutung gewonnen und mit Bewunderung und Hochachtung blicken die auswärtigen Fachgenossen auf die von ihr ausgehenden Leistungen.

Dieser hochgeschätzten und angesehenen Gesellschaft in der sich die wissenschaftlich chemischen Kräfte Englands zusammengeschlossen haben, bringe ich, zugleich im Namen der *Deutschen Chemischen Gesellschaft*, die herzlichsten Wünsche für ihr Gedeihen und ihre glückliche Weiterentwickelung bis in eine ferne Zukunft!"

"THE GUESTS."

Sir WILLIAM A. TILDEN: "The object of this gathering is to offer to our senior Past Presidents an expression of affectionate homage. On such an occasion we desire before all things the sympathy of our friends. I rise, therefore, with great pleasure, to ask you to return thanks to the large number of eminent men who have assembled with us to-night, and who, by their presence and by the words which have been expressed by some of them, have added lustre and fervour to the occasion. Among them are, not only representatives of science, but of a great variety of other interests, and this is a proof that our senior Past Presidents are known and honoured far beyond the circle which is represented by the Chemical Society. I will only venture to mention the names of a few of our guests, and the toast which I have the pleasure to propose will be coupled with three of them. We have with us a member of the Government, and we are glad to be honoured by his presence; the House of Commons is strongly represented by half a dozen eminent members. Then there are the President and the Secretaries of the Royal Society, who are never missing on any occasion when honour is to be given to the votaries of science, and we have the President and Treasurer of the famous Royal Institution, the home of chemistry from Davy to Dewar. To the Presidents of the French and German Chemical Societies we owe a very special expression of thanks, not only for their kind and sympathetic words, but for the immense trouble they have taken in making long journeys for the express purpose of attending to-night. The Presidents of a number of kindred societies which work on similar lines to the Chemical Society are also present, as well as representatives of other institutions, educational, scientific, and so forth. Among these representatives I hope you will excuse me if I refer specially to the venerable Chancellor of the University of Aberdeen. Beside these, we have a number of gentlemen representing not only science, but literature, while a very eminent sculptor sits not far from me. I give you the toast of 'The Guests,' coupled with the names of his Grace the Duke of Northumberland, who is expected to become a member of the Council of the Royal Society, Mr. Herbert Samuel, Postmaster-General, and Herr Eyde, who represents what may be called the chemical industry of the future."

The DUKE OF NORTHUMBERLAND: "We have felt it a very great honour to be the guests of yourselves upon this occasion, and to have had the privilege of joining in honouring the distinguished Past Presidents whom you have honoured to-night. I should like to say a word or two to express my admiration of, and gratitude to, Sir William Crookes. We all know that he has gone through many arduous struggles, and we know that he has made a reputation for manipulation, for patience, and research. I venture to think no finer manipulation has been displayed by him or greater patience than that of piloting the President of the Royal Institution through his duties. I am struck by the great advances in civilisation which are depicted by the menu. I see on the outside a very fine picture, the portraits of five Past Presidents of this Society; but I observe there is a sixth who occupies a very large space in the page, and I have no doubt it is a very distinguished Past President of the Chemical Society. I can only say that if I had had to dine with him I should have brought with me hard-boiled eggs! If one looks at the menu, he will see that chemistry is devoted to a very different object from which it is supposed to be. Some gentlemen might perhaps inform us what chemical action is going on now. I thank you on behalf of the guests."

The Right Hon. HERBERT SAMUEL, M.P.: "At this hour I shall earn your gratitude if I suppress the speech I should otherwise have delivered—incisive, eloquent, brilliant, humorous, and perhaps lengthy, as you may assume it would otherwise have been. I wish to join in expressing the gratitude of the guests for the invitation that has been tendered to us. It has been a privilege to us all to join in doing honour to men whose lives have been finely spent, men who have pursued research for its own sake. They have 'set their hearts upon the goal, not on the prize,' and have added fresh lustre upon the annals of British science."

HERR GENERALDIREKTOR S. EYDE: "So many eminent speeches have been made here to-night that were it not for the fact that I have been called upon to speak, I should never have ventured to do so.

Having, however, been afforded this opportunity, I feel it to be a great pleasure to thank you for your kindness and hospitality, and for the great honour you have done me in inviting me here to-night, and I am sure that all the other foreign guests will join me in my most cordial thanks to the Society for this honour.

It is, for me especially, a great pleasure to be present, as this

Society represents the British chemical science which primarily gave the world the idea of the important problem of fixing the nitrogen of the air.

A hundred years ago Priestley and Cavendish discovered what Lord Rayleigh, Sir William Ramsay, and, above all, Sir William Crookes successfully developed.

In Professor Birkeland's and my work on the same problem, *these* names served as beacons in the atmosphere, and guided us on our way, so that we have *British* science to thank in many respects for our success in creating an industry upon the problem of the fixation of the nitrogen of the air.

Formerly your countrymen came over to Norway to view the scenery of our large waterfalls and mountains, but to-day we send these natural properties to this country, in the form of a fertiliser, to enrich your soils.

We have sent this product to almost all parts of the world, and it is particularly interesting to note that the results have proved better in the British Isles than anywhere else, and I can only regard the fact that the Norwegian air put into British soil gives such good results, as a sign of the strong feeling of sympathy which, I am proud to say, prevails between our countries.

I wish to conclude these words with the toast of the further prosperity of this famous and distinguished Society."

Thursday, November 17th, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. Harry Farrands and Percy G. Ward were formally admitted Fellows of the Society.

The PRESIDENT read the following letter:

Home Office, Whitehall,
July 6th, 1910.

SIR,—I am commanded by the King to convey to you hereby his Majesty's thanks for the loyal and dutiful address of the President, Council, and Fellows of the Chemical Society, expressing their sympathy with his Majesty on the occasion of the lamented death of his late Majesty King Edward the Seventh, and congratulation on his Majesty's accession to the throne.

I am, Sir, your obedient servant,
WINSTON S. CHURCHILL.

The Hon. Secretary,
The Chemical Society,
Burlington House, W.

The PRESIDENT stated that he had received the following letter from Professor Körner:

MILANO LI 8 *Ottobre*, 1910.

HOCHGEEHRTER HERR PRÄSIDENT:

Die Feier, welche Freunde und Collegen gelegentlich der 70ten Wiederkehr meines Geburtstages (20. April, 1839) veranstaltet haben und die erst am 15. Mai dieses Jahres zur Ausführung kommen konnte, hat eine ganz besondere Zierde empfangen durch die nur allzu schmeichelhafte Anerkennung, welche die Chemische Gesellschaft zu London in prächtig ausgestatteter Adresse meinem Wirken als Lehrer und Forscher hat zu Theil werden lassen. Ich brauche Ihnen wohl nicht zu sagen, wie sehr mich diese wohlwollende Beurtheilung erfreut hat und wie hoch ich die Ehre schätze, die ich dadurch erhalten habe.

Ich bitte die Chemische Gesellschaft, und zugleich ihren Präsidenten, Herrn Professor Harold B. Dixon, meinen wärmsten Dank für diese Ehrung entgegenzunehmen und verbleibe, Herr Präsident, mit ausgezeichneter Hochachtung.

Ihr,
sehr ergebener,
PROF. W. KÖRNER.

Herrn Professor Harold B. Dixon, F.R.S.,
Präsident der Chemischen Gesellschaft zu London.

The PRESIDENT announced that the Eighth International Congress of Applied Chemistry would be held in Washington and in New York in September, 1912.

He also announced that a letter had been received from the Board of Trade drawing the attention of Fellows of the Society to the forthcoming International Exhibition to be held in Turin next year. A Royal Commission under the chairmanship of the Earl of Lytton is now engaged in organising exhibits illustrative of British Industry and Agriculture. The formation of a Scientific Section in the Exhibition is proposed.

Certificates were read for the first time in favour of Messrs.:

Edward Anderson, Hill View House, Waun Wen Road, Swansea.
Walter Norman Burbridge, Uplands, Foxley Lane, Purley.
John Fisher Carmichael, B.Sc., Tower Building, Liverpool.
Henry George Alan Harding, Darling Street, Chatswood, Sydney, N.S.W.
William Alfred Jenkin, 6, Bella Vista, Rio Tinto, Spain.

John Watterson Miller, Lynwood, Cantilupe Street, Hereford.
Walter Roman Moore, 55, Gloucester Street, Norwich.
Frank Henry Plews, 28, Gellatly Road, St. Catherine's Park, S.E.
Henry Stanley Raper, 599, Spadina Avenue, Toronto.
George Douglas Summers, Easington Lodge, Sproughton, Ipswich.

Certificates have been authorised by the Council for presentation to Ballot under Bye-law I (3) in favour of Messrs.:

Charles Crichton, Afrikander Mine, Klerksdorp, Transvaal.
Marshall Perley Cram, A.M., Ph.D., Brunswick, Maine, U.S.A.
Count Arnaud de Gramont, Rue de l'Universite 49, Paris.
Alleyne Leechman, B.A., 55, Main Street, Georgetown, British Guiana.
John Fleming Culun Brown Vance, 947, Richard Street, Vancouver, B.C.

Of the following papers, those marked * were read:

*300. "Preparation of secondary amines from carboxylic acids Part I. Preparation of heptadecylaniline, pentadecylaniline and tridecylaniline." By Henry Rondel Le Sueur.

Heptadecylaniline, $C_{17}H_{35}\cdot NH\cdot C_6H_5$, is readily obtained by heating α-anilinostearic acid, $C_{16}H_{33}\cdot CH(NHPh)\cdot CO_2H$, to considerably above its melting point, whereby it loses carbon dioxide:

$$C_{16}H_{33}\cdot CH(NHPh)\cdot CO_2H \longrightarrow C_{17}H_{35}\cdot NH\cdot C_6H_5.$$

The compound crystallises from alcohol in needles, melting at 42—43°, and boils at 285—286°/35 mm. Its *hydrochloride* melts at 99—100°.

Pentadecylaniline, $C_{15}H_{31}\cdot NH\cdot C_6H_5$, similarly obtained from α-anilinopalmitic acid, $C_{14}H_{29}\cdot CH(NHPh)\cdot CO_2H$, melts at 34—35°, and boils at 271°/40 mm. Its *hydrochloride* melts at 97·5°.

Tridecylaniline, $C_{13}H_{27}\cdot NH\cdot C_6H_5$, obtained from α-anilinomyristic acid, $C_{12}H_{25}\cdot CH(NHPh)\cdot CO_2H$, melts at 23—24°, and boils at 251°/35 mm.

The author is now engaged in the investigation of the application of the above reaction to the preparation of secondary amines, and more particularly of substituted anilines and naphthylamines.

*301. "The wet oxidation of metals. Part I. The rusting of iron." By Bertram Lambert and James Campbell Thomson.

The work published up to the present time on the subject of the rusting of iron cannot be held to prove the fact that pure iron will not undergo visible oxidation in contact with pure water and pure oxygen. In almost all previous investigations, commercial iron of the highest obtainable degree of purity has been used, but, from a chemical point of view, the impurities contained in the iron must have been considerable, even in the most favourable circumstances.

The authors have shown that pure iron, prepared from pure ferric nitrate by igniting to form the oxide and subsequently reducing in a pure iridium boat in a current of pure hydrogen, does not show visible oxidation after long exposure to pure water and pure oxygen.

The experiments were carried out in vessels of clear fused silica, the water was distilled in a vacuum from a solution of barium hydroxide, and the oxygen was prepared by the electrolysis of a solution of highly purified barium hydroxide.

It has been shown, further, that iron containing a slight trace of impurity will undergo oxidation under the same conditions, even when there is no possibility of an acid substance being either present or formed during the reaction.

DISCUSSION.

The PRESIDENT asked whether Mr. Lambert had taken any measures to free the electrolytic oxygen from diffused hydrogen before bringing it into contact with the iron. He expressed his conviction that Mr. Lambert had amply proved that iron purified by the method described was not oxidised in contact with water and oxygen.

Sir W. RAMSAY suggested that stopcocks, greased at the ends with grease and lubricated with phosphoric oxide in the middle round the bore, held tight. He also pointed out that silica dissolves to some extent in water, and that an acid solution (?) might be formed; but pure iron is not attacked by strong acids, and a priori would not be attacked by water.

Professor ARMSTRONG expressed the opinion that the results brought forward in no way affected the conclusions arrived at by Moody and confirmed by Friend. It was to be expected, on theoretical grounds, that iron would not be attacked to any appreciable extent if highly purified; action should take place only in presence of a relatively electronegative conductor, such as platinum; in point of fact, the results arrived at were such as should be arrived at, and were in no way surprising. That rusting would take place under the conditions described if impure iron were used was also to be expected; in carrying out the experiments, apparently, no proper care had been taken to exclude carbon dioxide; it was well known that this gas was obstinately retained by glass surfaces and could not be removed by mere evacuation.

The speaker also suggested that the term "purified" should be used instead of "pure" throughout the communication.

Mr. Arnold Philip asked whether the authors had tried the action of pure oxygen and water on a mixture of two portions of the same sample of pure iron, one of which portions had been strained mechanically, for instance, by hammering, and the other portion being retained in an unstrained condition. It occurred to him that such a mixture might behave similarly to the mixture of pure iron with traces of platinum described by the authors.

Mr. Lambert, in reply to the President, said that the construction of the electrolytic cell precluded the possibility of the diffusion of hydrogen into the oxygen; any hydrogen which diffused back from the cathode must escape into the reservoir of the cell.

In reply to Sir W. Ramsay, he stated his opinion that a glass stopcock, treated as suggested, would not prevent a slow leakage of gas round the barrel of the stopcock if it were lubricated with phosphoric acid, and if the conditions were such that there was a wet gas on one side of the stopcock and a high vacuum on the other side; in time the lubricant must be partly washed away. There was no question of leakage from the outside of the stopcock, since it was mercury-sealed.

In reply to Professor Armstrong, he said that he could not agree that the experiments did not affect the conclusions arrived at by Moody. Moody's contention was that pure iron would only undergo oxidation in contact with water and oxygen when carbon dioxide, or some such acid gas, is present; that, in the absence of this last condition, pure iron will not rust. Moody's experiments were conducted with impure iron and air which was only freed from acid gases; the conditions of experiment were further complicated by his method of treating the iron, so that no simple conclusion could be drawn from his experiments, and certainly none which could be applied to pure iron. Mr. Lambert said that experiments (an account of which was shortly to be presented to the Society) which had been carried out since this paper had been submitted showed that pure iron, made according to the method described in the paper, could be exposed to water and ordinary air without undergoing oxidation—a result which showed that Moody's contention was not true.

With regard to the use of the term "pure," such a term could only be used with a relative meaning in chemistry.

Experiments on the lines of Mr. Philip's suggestion had not been carried out.

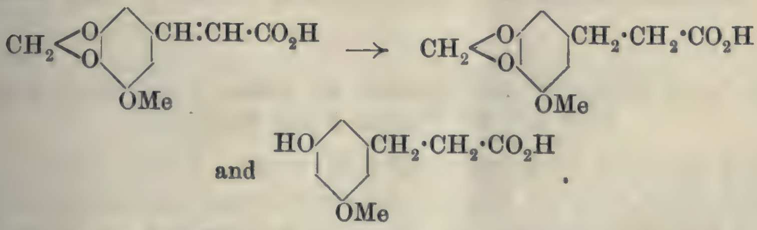
302. “The colour and constitution of diazonium salts. Part III. The diazo-derivatives of 2 : 7-naphthylenediamine.” By Gilbert T. Morgan and Frances M. G. Micklethwait.

Both the amino-groups of 2 : 7-naphthylenediamine can be diazotised by operating with sodium nitrite or nitrosyl sulphate in moderately concentrated sulphuric acid. The addition of ether and alcohol to this solution caused the precipitation of *naphthalene-2 : 7-bisdiazonium sulphate*, $C_{10}H_6(N_2{\cdot}HSO_4)_2,\frac{1}{2}C_2H_5{\cdot}OH$ (compare Kaufler and Karrer, *Ber.*, 1907, **40**, 3263). This salt was utilised in the preparation of *naphthalene-2 : 7-bisdiazonium platinichloride*, $C_{10}H_6(N_2)_2PtCl_6,2H_2O$, *aurichloride*, $C_{10}H_6(N_2{\cdot}AuCl_4)$, and *dichromate*, $C_{10}H_6(N_2)_2{:}Cr_2O_7$. These bisdiazonium salts are decomposed quantitatively by sodium azide, yielding 2 : 7-*bistriazonaphthalene* (*naphthylene-2 : 7-bisazoimide*), $N_3{\cdot}C_{10}H_6{\cdot}N_3$ (m. p. 98°), and when subjected to the Sandmeyer reaction in presence of hydrochloric acid they furnish 2 : 7-dichloronaphthalene (m. p. 114°).

These results were employed in the discussion of the authors' views on the constitution of diazonium salts.

303. “Action of sodium amalgam on methylene ethers.”
By Arthur Henry Salway.

The author has investigated the action of sodium amalgam on 3-methoxy-4 : 5-methylenedioxycinnamic acid, and has found that the normal reaction is accompanied by a secondary change involving the disruption of the methylenedioxy-complex and the formation of β-5-hydroxy-3-methoxyphenylpropionic acid, according to the following scheme :



A similar change was shown to be general in the case of those aromatic methylene ethers which contain an aliphatic side-chain unsaturated in the αβ-position with respect to the benzene nucleus.

304. "The homogeneous decomposition of ozone in the presence of oxygen and other gases." By David Leonard Chapman and Herbert Edwin Jones.

The authors have continued the work of Clarke and Chapman, in which it was shown that the decomposition of ozone in glass vessels of a sufficient size is a homogeneous change.

The results obtained have demonstrated that:

(*a*) Oxygen, nitrogen, carbon dioxide, and possibly water vapour have no effect on the rate of decomposition of ozone, that is, the rate of decomposition of ozone in the presence of these gases is a function of the concentration of the ozone only.

(*b*) Nitrogen peroxide (Andrews) and chlorine accelerate in a marked degree the decomposition of the gas.

(*c*) If the order of the change can be represented exactly by an integral ordinal number, that number is the second.

305. "The addition of bromine to unsaturated compounds. Part II." By John Joseph Sudborough and John Thomas.

The addition of bromine to the following acids in carbon tetrachloride solution at 15° has been studied: Cinnamylideneacetic and *allo*cinnamylideneacetic acids, sorbic and hydrosorbic acids, the three dihydrocinnamylideneacetic acids, and crotonic, angelic, tiglic, β-dimethylacrylic, and trimethylacrylic acids.

The results confirm the conclusion already drawn, namely, that acids with an olefine linking in the $\alpha\beta$-position react with bromine much less readily than isomeric $\beta\gamma$- or $\gamma\delta$-acids.

The presence of several methyl groups in the acrylic acid molecule. facilitates the addition of bromine to the acid.

306. "Intermolecular condensation of aromatic sulphinic acids Part I." By Thomas Percy Hilditch.

It is found that when the chlorides of aromatic sulphinic acids are heated to 60—100° or kept in cold concentrated sulphuric acid, or when the free sulphinic acids are left for some time in sulphuric acid solution, a decomposition takes place, the nature of which is chiefly determined by the substituents in the aromatic nucleus. Thus, in general, those acids in which the para-position with respect to the sulphinyl group is unsubstituted give varying proportions of insoluble compounds of high melting points and of the corresponding disulphoxide, whilst if that position is occupied, small amounts of disulphoxide only are formed. With the heated sulphinyl chlorides, disulphides may appear with, or in place of, the disulphoxides.

The insoluble derivatives possess the composition :

$$R\cdot C_6H_3\colon S_2O_2\colon C_6H_3\cdot R,$$

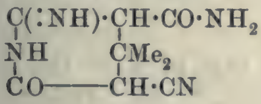
and were found to be closely connected with the insoluble by-products nearly always formed in syntheses of thianthrene. It has further been proved that the insoluble product thus obtained from benzenesulphinic acid is analogous to the "*iso*thianthrene" described by Genvresse, and that, since *p*-dichlorobenzene and benzene-*p*-disulphonyl chloride result from the action of phosphorus pentachloride on the compound, the sulphur atoms are united to each benzenoid residue through the para-carbon atoms. It is accordingly suggested that the term "*iso*thianthrene" be replaced by the more appropriate "parathianthrene."

On account of the sparing solubility and volatility of these derivatives, it has been impossible to determine the molecular complexity of the parathianthrenes, but further proof of their para-configuration lies in their non-appearance from any para-substituted sulphinic acids.

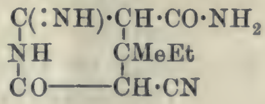
307. "Formation of a six-membered ring through the agency of the imino-group." (Preliminary note.) By Ferdinand Bernard Thole and Jocelyn Field Thorpe.

It is found that an open chain of five carbon atoms and one nitrogen atom readily passes into the six-membered ring through the agency of the imino-group.

Thus, when acetone is condensed with cyanoacetamide in the presence of piperidine or sodium hydroxide, an almost quantitative yield of the imino-imide (I) is formed, and when methyl ethyl ketone is used in place of acetone an equally good yield of the imino-imide (II.) is produced.

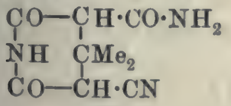


(I.)

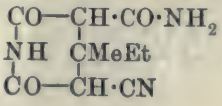


(II.)

These substances are tautomeric imino-amino- (ketimino-enamic) derivatives, which are quickly hydrolysed by dilute mineral acids, forming the imides (III.) and (IV.) respectively.



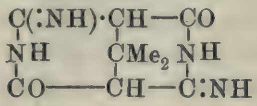
(III.)

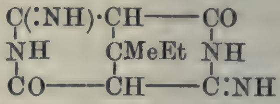


(IV.)

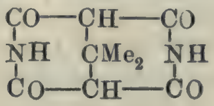
Either from the imino-imides or from the imides a quantitative yield of the ββ-substituted glutaric acid is formed on acid hydrolysis.

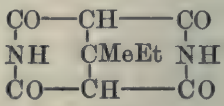
The imino-imides (I.) and (II.) undergo a further imino-condensation when treated with sodium ethoxide, yielding the di-imino-di-imides (V.) and (VI.).


(V.)


(VI.)

These substances are tautomeric di-iminodiamino-compounds, which are readily hydrolysed by dilute mineral acids, forming the di-imides (VII.) and (VIII.) respectively.

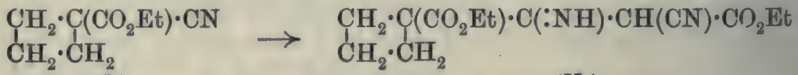

(VII.)


(VIII.)

These compounds are also converted into the corresponding dialkylglutaric acids on complete acid hydrolysis.

308. "An instance illustrating the stability of the four carbon ring." By Arthur Fred Campbell and Jocelyn Field Thorpe.

It was shown that under the same experimental condition that produce ethyl αα-dicyanoadipate from ethyl 1-cyano*cyclo*propane-1-carboxylate and ethyl cyanoacetate, the corresponding *cyclo*butane derivative, ethyl 1-cyano*cyclo*butane-1-carboxylate (I), is converted into an imino-compound (II.).


(I.) (II.)

The derivatives of this imino-compound were described.

309. "Narcissine: an alkaloid from the bulb of the common daffodil (Narcissus Pseudonarcissus)." By Arthur James Ewins.

A new alkaloid, *narcissine*, has been isolated from the bulb of the common daffodil (*Narcissus Pseudonarcissus*). It has been shown to possess the formula $C_{16}H_{17}O_4N$, melts at 266—267°, and is lævorotatory ($[\alpha]_D - 95{\cdot}8°$). It contains no methoxy-groups, and is characterised by great stability.

The *hydrochloride*, $C_{16}H_{17}O_4N,HCl$, was also described.

310. "Preparation of ammonium nitrite by the sublimation in a vacuum of a mixture of ammonium chloride and alkali nitrites." By Pañchañan Neogi and Birendra Bhusan Adhicāry.

The authors have prepared in fairly large amount the unstable compound, ammonium nitrite, by evaporating and subliming in a vacuum a concentrated solution of ammonium chloride and alkali nitrites. The method of preparation of the compound, its properties, and the results of vapour density determinations by Hofmann's method at different temperatures were described.

311. "The action of halogens on mercuricamphor compounds." By James Ernest Marsh.

Di-iodocamphor is formed by the action of iodine on each of the three mercuricamphor compounds, $C_{10}H_{14}O,Hg_2I_2$, $(C_{10}H_{14}O)_3Hg_4I_2$, and $(C_{10}H_{14}O)_4Hg_5I_2$. Di-iodocamphor is decomposed in solution by the oxygen of the air with liberation of iodine and formation of camphorquinone. Di-iodocamphor and the mercuricamphors are thus shown to be $\alpha\alpha'$-derivatives of camphor. The action of bromine on dimercuricamphor compounds and on di-iodocamphor gives $\alpha\alpha'$-dibromocamphor.

312. "The absorption spectra of various diketopyrroline compounds." By John Edward Purvis.

The results of this investigation show that (1) the diketonic structure gives rise to the production of a well-marked colour and absorption; (2) the introduction of a methyl or a propyl group in an aromatic side-chain produces no fundamental change in the colour or the absorption; (3) the introduction of an anisyl or a piperonyl group in an aromatic side-chain does not fundamentally alter the colour or the corresponding absorption; but another more refrangible band is produced characteristic of each type of radicle; (4) the replacement of oxygen in a ketonic group by phenylhydrazine produces a change in the colour and the absorption, so that two bands are developed, the less refrangible one being the stronger; (5) the replacement of both oxygen atoms and the establishment of a phenazine ring is marked by a further change in the colour from red to yellow, a decrease in the strength of the less refrangible band, and an increase in the strength of the more refrangible one; (6) the increased weighting of the molecule shifts the positions of general absorption towards the more refrangible regions.

313. ' Studies of the processes operative in solutions. Part XII. The apparent hydration values of acid-systems and of salts deduced from a study of the hydrolytic activities of acids." By Frederick Palliser Worley.

An account was given of an extended series of observations on the behaviour of cane-sugar in aqueous solutions towards chlorhydric and nitric acids, and of the influence of salts on the rate of change. The results were discussed with reference especially to the determination of the apparent hydration value of the solutes.

314. "Studies of the processes operative in solutions. Part XIII. The depression of the hydrolytic activity of acids by paraffinoid alcohols and acids." By Henry E. Armstrong and Frederick Palliser Worley.

It was shown that the depressant influence increases as the molecular weight of the depressant increases.

315. "Studies of the processes operative in solutions. Part XIV. The determinations of apparent hydration values by means of raffinose." By Walter Hamis Glover.

The values arrived at when raffinose is hydrolysed in presence of salts were shown to be practically identical with those obtained on using cane-sugar as hydrolyte.

316. "Studies of the processes operative in solutions. Part XV. The changes effected by the reciprocal interference of sugar (and glucosides) and salts in aqueous solutions." By Walter Hamis Glover.

This communication is an extension of the work described in Part X (*Proc. Roy. Soc.*, 1908, **81**, *A*, 117), in which the effect of cane-sugar on the rotatory power and electrical conductivity of solutions of various salts was considered. The sugars studied are raffinose, together with melibiose, milk sugar and α- and β-methylglucoside.

317. "Studies of the processes operative in solutions. Part XVI. The determination of optical rotatory power." By Frederick Palliser Worley and Walter Hamis Glover.

Various refinements were described that have been made use of in carrying out the determinations described in Parts XII.—XIV.

318. "**Studies of the processes operative in solutions. Part XVII. The relative efficiencies of acids as deduced from their conductivities and hydrolytic activities (II).**" **By Henry E. Armstrong and Edward Wheeler.**

The acids studied are chlorhydric, bromhydric and iodhydric—the acids formed by the dissolution of the three hydrides HCl, HBr, HI.

319. "**Studies of the processes operative in solutions. Part XVIII. The depression of electrical conductivity by non-electrolytes.**" **By Henry E. Armstrong and David Crothers.**

Results were given showing the effects produced at 0° and 25°. Attention was particularly directed to the remarkable manner in which the depressant effect increases as the molecular weight of the depressant increases.

320. "**Studies of the processes operative in solutions. Part XIX. The complexity of the phenomena afforded by solutions: a retrospect.**" **By Henry E. Armstrong.**

A summary was given of the results recorded in previous communications of the series and their bearing on the problems afforded by solutions was discussed.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Michaelis, *Leonor.* Dynamik der Oberflächen. pp. iv + 88. Dresden 1909. (*Recd.* 3/11/10.) From the Author.

Molinari, *Ettore.* Trattato di chimica inorganica. pp. xvii + 924. ill. 3rd edition. Milano 1910. (*Recd.* 7/11/10.) From the Publisher: Ulrico Hoepli.

Villavecchia, *Vittorio.* Dizionario di merceologia e di chimica applicata. 3rd edition. Vol. I, A–M. pp. xv + [779]. Milano 1910. (*Reference.*) From the Publisher: Ulrico Hoepli.

II. *By Purchase.*

Grimmer, *W.* Chemie und Physiologie der Milch. pp. xii + 364. ill. Berlin 1910. (*Recd.* 16/11/10.)

Herzog, *Alois.* Die Unterscheidung der natürlichen und künstlichen Seiden. pp. 78. ill. Dresden 1910. (*Recd.* 16/11/10.)

Holleman, *A. F.* Die direkte Einführung von Substituenten in den Benzolkern. Ein Beitrag zur Lösung des Substitutionsproblems in aromatischen Verbindungen. pp. vi + 516. Leipzig 1910. (*Recd.* 16/11/10.)

Richter, *Max Moritz.* Lexikon der Kohlenstoff-Verbindungen. Lieferung I. 3rd edition. pp. 160. Hamburg 1910. (*Reference.*)

Schwalbe, *Carl G.* Die Chemie der Cellulose. Part I. pp. 272. Berlin 1910. (*Recd.* 16/11/10.)

III. *Pamphlets.*

Gortner, *Ross Aiken.* On some new quinazoline derivatives. pp. 49. Easton, Pa. 1909.

Gutbier, *A.*, and **Bünz**, *R.* Zur Kenntnis der Wismutperoxyde. (From the *Sitzungsber. Physik.-Med. Soz. Erlangen*, 1908, **40**.)

Hämäläinen, *Juho.* Ueber isomere Borneolglykuronsäuren. (From the *Skand. Arch. Physiol.*, 1909, **23**.)

—— Zur Spaltbarkeit der Borneol- und Camphoglykuronsäuren durch Enzyme. (From the *Skand. Arch. Physiol.*, 1910, **23**.)

Heyl, *Georg.* Ueber die Alkaloide von Corydalis solida Sm. (From the *Apoth. Zeit.*, 1910, **25**.)

—— Ueber Corydalis aurea. (From the *Apoth. Zeit.*, 1910, **25**.)

Hintz, *E.* Ueber den Arsengehalt der Maxquelle zu Bad Dürkheim a.d. Haardt. (From the *Zeitsch. Balneol.*, 1910, **3**.)

Holsti, *Östen.* Zur Kenntnis des Phosphorumsatzes beim Menschen. (From the *Skand. Arch. Physiol.*, 1909, **23**.)

Hooper, *David.* The secretion of *Phromnia marginella*, Olivier. (From the *J. Proc. Asiatic Soc. Bengal*, 1909, N.S. **5**.)

Imperial Institute. Selected Reports from the Scientific and Technical Department. II. Gums and Resins. III. Foodstuffs. pp. 136 to 203, 200 to 267. London 1909, 1910.

Indian Association for the Cultivation of Science. Report for the year 1908. pp. 65. Calcutta 1909.

Jänecke, *Ernst.* Legierungen. pp. 100. ill. Hannover 1910.

Krogh, *August*, and **Krogh**, *Marie.* The mechanism of gas-exchange. I–VII. (From the *Skand. Arch. Physiol.*, 1910, **23**.)

Lehmann, *F.* Ueber den einfachsten Modus der Zuckerbestimmung in Harn. (From the *Apoth. Zeit.*, 1910, **25**.)

Luzzatto, *R.*, and **Satta**, *G.* Intorno al comportamento nell' organismo animale dei Jodoso-, Jodil e Jodonio-composti. I. Comportamento del Jodoso-benzolo. (From the *Arch. Farm. sperim.* 1909, **8**.)

Meyer, *J. de.* Allgemeine Bemerkungen über die glykolytischen Prozesse unter Bezugnahme auf die Arbeiten der Herren Stoklasa, Oppenheimer und Rosenberg. (From the *Zentr. Physiol.*, 1910, **23**.)

Meyer, *Julius.* Bemerkungen über die Fermente der Milch. (From the *Arbeiten aus dem Kaiserl. Gesundheitsamte,* 1910, **34**.)

Moir, *James.* Genetic connexions between the chemical elements. (From the *S. African J. Sci.*, 1910.)

Motolese, *Francesco.* Sulle proprietà farmacologiche dell'acido picrico. (From the *Arch. Farm. sperim,* 1910, **9**.)

Neuberg, *Carl.* Verhalten von racemischer Asparaginsäure bei der Fäulnis. (From the *Archiv. Fisiol.*, 1909, **7**.)

Neuberg, *Carl.* Zur Frage der Pigmentbildung. (From the *Zeitsch. Krebsforschung,* 1909, **8**.)

Oesterle, *O. A.*, and **Riat**, *G.* Zur Kenntnis des Aloins. (From the *Schweiz. Woch. Chem. Pharm.*, 1909.)

Patta, *Aldo.* Contributo allo studio della supposta azione ricostituente dei fosfati, dei glicero fosfati, delle lecitine sopratutto in condizioni di esaurimento e di depressione del sistema nervoso e del ricambio. pp. 83. Pavia 1909.

——— Osservazioni intorno al comportamento degli ipofosfiti nell' organismo. (From the *Arch. Farm. sperim.*, 1910, **8**.)

Rancken, *Dodo.* Ueber die Einwirkung der Massage auf den Eiweissumsatz im Organismus. (From the *Skand. Arch. Physiol.*, 1910, **23**.)

Reis, *Robert.* Phytochemische Untersuchung der Erythraea Centaurium Pers. pp. 46. Strassburg 1909.

Royal Society of Arts. Directory. Edited by *Sir Henry Trueman* **Wood**. pp. 76. London 1909.

Runne, *Ernst.* Titration von Alkaloidsalzen. (From the *Apoth. Zeit.*, 1909, **24**; 1910, **25**.)

Rupp, *E.*, and **Klee**, *W.* Ueber die Darstellung von Sublimat aus Quecksilbersulfat und Kochsalz auf nassem Wege. (From the *Apoth. Zeit.*, 1910, **25**.)

Rusconi, *Arnaldo.* Sulla ricerca dell'agrostemma nelle farine alimentari e nel pane col metodo dell' emolisi. (From the *Boll. Soc. Med.-Chir. Pavia*, 1910.)

—— L'emolisi come mezzo analitico per la ricerca delle saponine nella birra, nelle acque gazose, e nei vini. (From the *Boll. Soc. Med.-Chir. Pavia*, 1910.)

Santesson, *C. G.* Ueber die Einwirkung von Giften auf einen enzymatischen Prozess. (From the *Skand. Arch. Physiol.*, 1909, **23**.)

—— Ueber die Wirkung von Kaliumbromat. (From the *Arch. Fisiol.*, 1909, **7**.)

Scherer, *Hermann.* Ueber Phytosterine und einige fette Oele. pp. 63. Mülhausen i. E. 1909.

Serono, *Cesare.* Metodo per la preparazione dei Metalli colloidali stabili. (From the *Arch. Farm. sperim.*, 1910, **9**.)

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, December 5th, 1910.

All persons who received grants in December, 1909, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Thursday, December 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal tar and allied industries.

At the next Ordinary Scientific Meeting on **Thursday**, December 1st, 1910, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated :

"The triazo-group. Part XV. Triazoethylene (vinylazoimide) and the triazoethyl halides." By M. O. Forster and S. H. Newman.

"The determination of solubility coefficients by aspiration. Preliminary note." By W. J. Jones.

"The auto-reduction of hydrazines." F. D. Chattaway and M. Aldridge.

"The nitro-derivatives of dimethyl-*p*-toluidine." By G. T. Morgan and A. Clayton.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, December, 1st, 1910.

Applebey, Malcolm Percival,
Hill View, Foxcombe, near Oxford.

Fereday Fellow, St. John's College, Oxford. Part author of paper on "Some Physico-chemical Properties of Mixtures of Pyridine and Water" (Trans., 1908, p. 538). Research Assistant to the Earl of Berkeley.

Berkeley. N. V. Sidgwick.
E. G. J. Hartley. H. T. Tizard.
H. Hartley.

Banerjee, Manindranath,
3, Padmanath Lane, Shambazar, Calcutta.

Senior Lecturer of Chemistry, Bengal National College, Calcutta. Author of a series of papers entitled "India—through her Industries: I. Nitre Industry in Tirhut (Bengal)," being published in the *Modern Review* since May, 1910. Communicated a paper "On a Simple and Convenient Apparatus for the Determination of Equivalents of Metals and the Estimation of Carbon Dioxide both Directly and Indirectly," to the Chemical Society in May, 1910. Serving as Senior Lecturer in Chemistry and head of the Chemistry Department of the Bengal National College and School, Calcutta (India), since 1906. Studied three years in the Civil Engineering Department of the Government C. E. College, Sibpur (Bengal).

Paul Brühl. P. C. Rây.
Jyoti Bhushan Bhaduri. *Amrita Lal Sircar.*
Chuni Lal Bose.

Barwick, Fred Wilkinson,
Rathlyn, Kilmorey Gardens, St. Margaret's-on-Thames.

Senior Assistant and Mercers' Research Fellow, Scientific and Technical Department, Imperial Institute, London; now appointed

Manager, Public Textile Testing House, Technical Institute, Belfast. Associate, Bradford Technical College. Has specialised in the examination and testing of vegetable and animal fibres and textile materials.

Wyndham R. Dunstan. Ernest Goulding.
Thomas Anderson Henry. Henry H. Robinson.
Saml. S. Pickles.

Bhattacharya, Sarat Chandra, M.A.(Calcutta),
Hazaribagh, Bengal, India.

Professor of Chemistry, St. Columba's College, Hazaribagh. Passed the M.A. examination of Calcutta University from Hughli College in 1895. Has been a successful teacher of Chemistry for the last twelve years.

J. A. Cunningham. Bidhu Bhushan Dutt.
P. C. Rây. *Jyoti Bhushan Bhaduri.*
David Hooper.

Bosworth, Stewart McGregor,
65, Abingdon Villas, Kensington, W.

Chemical Assistant to J. Y. Buchanan, Esq., F.R.S., at Davy-Faraday Research Laboratory. Bachelor of Science (London); Member of the Pharmaceutical Society of Great Britain; sometime Assistant to Dr. H. Wilson Hake at Westminster Hospital Medical School; assisted in a Research on the "Hydrochloric Acid in Gastric Contents of Mice," which was published in the Royal Society's Proceedings: also in a Research on the "Poisonous Gases evolved from Ferro-Silicon," published in the Local Government Report, 1909, etc.

Alexander Scott. A. Liversidge.
J. Y. Buchanan. H. Wilson Hake.
Hugo Müller.

Bracher, André,
30, Guilford Street, London, W.C.

Analytical Chemist. Assistant for five years to A. W. Stokes, Esq., F.I.C., F.C.S. (Public Analyst). Student four years, Polytechnic, Regent St. (Chemistry, etc.). Present position, Analyst to Dairy Supply Co., Ltd., Museum St., W.C.

Frank E. Weston. Cecil Revis.
Wm. Hy. Collier. H. R. Ellis.
Alf. W. Stokes. John Wilson.

Brady, Frederick Hugh Rochfort,

12, Park View Avenue, Harolds Cross, Dublin.

Chemist. Pharmaceutical Chemist, Ireland, by examination.

Henry I. Gorman.
Henry Boyers.
John Gerard Hughes.
Thomas Tyrer.
Philip F. Rowsell.
C. G. Moor.

Briggs, John C.,

East View or Gas Works, Workington.

Gas Engineer. Assistant Engineer and Chemist, Workington Corporation Gas Dept. Consulting Engineer to a number of small gas undertakings. Member Society Chemical Industry. Graduate Inst. Mech. Engineers. Honoursman: Gas Engineering, Manufacture and Distribution, and other Science subjects. Varied experience and investigations as Consultant in the Chemistry of Gas manufacture and by-products, and the design of apparatus.

Jas. D. Dougall.
Frank Wood.
Pattinson B. Melmore.
W. H. Watson.
J. Robinson.

Briscoe, Henry Vincent Aird,

33, Bargery Road, Catford, S.E.

Professor's Assistant in the Royal College of Science (Department of Chemistry). Associate of the Royal College of Science (in Chemistry); Bachelor of Science (London).

T. E. Thorpe.
M. O. Forster.
G. T. Morgan.
James C. Philip.
F. P. Dunn.

Brown, John,

Technical Institute, Timaru, New Zealand.

Director of Agricultural Instruction. B.Sc. (Glasgow). Four years training in the Chemical laboratories of Glasgow University and the West of Scotland Agricultural College; formerly lecturer on Agriculture and on Soils and Manures in the West of Scotland Agricultural College, and expert on Manures and Feeding Stuffs to the County Gentlemen's Association; now in charge of the laboratory of the Technical Institute, Timaru, and conducting investigations in the department of agricultural chemistry.

H. W. Potts.
Robt. D. Watt.
R. A. Berry.
H. H. Green.
Cecil H. Desch.

Buttle, Bertram Haward,

63, Claremont Road, Forest Gate, London, E.

Science Master, Archbishop Holgate's School, York. Two contributions to the Society, jointly with Dr. J. T. Hewitt: "Solubility of Silver Chloride in Mercuric Nitrate," and "Constitution of Polynitrophenols in Alkaline Solution."

J. T. Hewitt. Clarence Smith.
F. G. Pope. F. S. Long.
C. Müller.

Camp, Frank Anthony,

c/o Parry & Co., Madras, India.

Chemist. Analyst to Messrs. Parry & Co., Sugar Refiners, Madras; formerly Assistant Chemist to Messrs. Garton, Hill & Co., Battersea.

Leonard Temple Thorne. Charles A. Keane.
B. E. R. Newlands. E. Haynes Jeffers.
J. C. Crocker.

Challenger, Frederick,

324, Mansfield Road, Carrington, Nottingham.

Research Student in Organic Chemistry. B.Sc. (Lond.); A.I.C.; 1851 Exhibition Scholar, 1910. Educated at Ashville College, Harrogate. Obtained London B.Sc. (Honours) in Chemistry after three years' work at Derby Technical College. Research Scholarship at University College, Nottingham, since Jan., 1908. Publications—jointly with Prof. F. S. Kipping, F.R.S.—"Organic Derivatives of Silicon. Part XII"; "Dibenzylethylpropylsilicane and Sulphonic Acids derived from it. Part XIII"; "Optically Active Compounds containing One Asymmetric Silicon Group." Unpublished research on "Organic Derivatives of Phosphorus." Proceeding to University of Göttingen in Oct., 1910, to work under Prof. Otto Wallach.

F. Stanley Kipping. R. M. Caven.
Henry J. S. Sand. W. N. Haworth.
J. H. A. Hebron. A. Jamieson Walker.

Colgate, Reginald Thomas,

Bromfield, 26, Birdhurst Rise, S. Croydon.

Assistant Demonstrator. Now occupying post as Lecture-Assistant at City and Guilds Institute, Central Technical College. Joint author (with Mr. E. H. Rodd) of Paper communicated to the Society, June, 1910: "Sulphonic Derivatives of the 1:4-Di-derivatives of Benzene containing Halogens."

Henry E. Armstrong. J. Vargas Eyre.
T. Martin Lowry. W. Robertson.
Fredk. P. Worley.

Coslett, Thomas Watts,

Steel Road, Northfield, Worcestershire.

Inventor and Patentee of the Coslett Anti-Rust Process. Author of Papers relating to the above method. Interested in Chemical Science generally, especially with regard to oxidation of metals.

H. W. Jones.	Arthur Adams.
Harry Silvester.	*R. Lloyd Whiteley.*

F. M. Thomas.

Crawford, David Chalmers,

Elsenburg, Mulders Vlei, Cape Colony.

Lecturer in Chemistry, Government College of Agriculture, Elsenburg. Graduate of Aberdeen University; M.A., B.Sc., B.Sc.Agr. Lecturer in Chemistry, and Analytical Chemist, Elsenburg.

James Hendrick.	F. R. Japp.
George N. Blackshaw.	*James Moir.*

E. V. Flack.

Davies, John Hughes,

St. Peter's College, Peterborough.

Vice-Principal of St. Peter's College (for the Training of Teachers), Peterborough. B.Sc. (Univ. of Wales); Ph.D. (Univ. of Leipzig); formerly 1851 Exhibition Scholar, and Assistant in Physical Chemistry at Leipzig. Have published several scientific researches:—Perman and Davies: *Proc. Roy. Soc.*, **76**, p. 173, 1905; *Chem. News*, May 18th, 1906; *Proc. Roy. Soc.*, **78**, p. 28; *Trans. Chem. Soc.*, **91**, p. 1113, 1907. Le Blanc and Davies: *Zeits. f. Elektroch.*, **14**, 361, 1907. Davies: *Proc. Roy. Soc.*, **78**, p. 41, 1906; *Zeits. f. physik. Chem.*, **64**, p. 657, 1908; Inaug. Dissert., Univ. of Leipzig, 1908.

Claude M. Thompson.	E. P. Perman.
Robt. D. Abell.	Norman Picton.

F. P. Armitage.

Dodd, Arthur,

"Lyndhurst," Belvedere, Kent.

Manager of Messrs. C. Price & Co.'s Oil Works at Belvedere. I have been engaged in practical oil refining and manufacture of oil products for the last 16 years, and am desirous of following chemical literature by studying papers appearing in the Journal of the Chemical Society.

J. Lewkowitsch.	Wesley Lambert.
Robert Redwood.	J. B. Gall.
L. Myddelton Nash.	*H. Heron Smith.*

Duncan, James Hugh,
18, Park Place, Cardiff.

Analytical and Consulting Chemist. For last two years general partner of Treharne and Duncan, Analytical and Consulting Chemists, 125, Bute Street, Cardiff. Student for four years at Merchant Venturer's Technical College, Bristol. Sat for London B.Sc. Hons. in Chemistry, obtaining exemption from Pass Exam. in that subject. Obtained Second Class Hons. in Practical Chemistry Board of Education. Desires making extended use of your library and publications.

J. Wertheimer. F. Gwilym Treharne.
F. W. Rixon. *Bernard Dyer.*
H. Stanley. *Frank W. G. King.*

Emmett, William Gidley,
Caius College, Cambridge.

Student. Nat. Sciences Tripos, Pt. I., 1st Class; Pt. II. (Chemistry), 2nd Class. Formerly Scholar of Gonville and Caius College, Cambridge. Engaged in research.

H. O. Jones. Charles T. Heycock.
W. J. Pope. H. J. H. Fenton.
J. G. M. Dunlop.

Ensor, Ainslie Jackson, B.Sc. (Birm.),
67, Cannon St., Wellingboro', Northants.

Principal, Wellingborough Technical Institute. 1903–1906, Student University of Birmingham; 1906–1908, Tutor (Science) Training College for Men, Univ. of Birm.; Demonst. Chemistry, Sutton Coldfield Tech. School, 1906–1908; also at Selly Oak and Stirchley.

Percy F. Frankland. C. K. Tinkler.
Alex. Findlay. Alex. McKenzie.
Henry Wren.

Finlayson, John George,
13, Monarch Terrace, Blaydon-on-Tyne.

Cambridge University, Natural Sciences Tripos, Part I, June, 1907. Science Master, Blaydon Secondary School. Instructor in Chemistry, Durham County Council.

Charles T. Heycock. Henry Jackson.
W. J. Pope. Duncan T. Richards.
W. J. Sell. *Arthur J. Berry.*
J. E. Purvis.

Goddon, George Alexander,

18, Rylett Crescent, Shepherd's Bush, W.

Manufacturing Chemist. Am desirous of coming in touch with current scientific literature.

C. T. Bennett. Edwin Harrison.
W. Carter White. Ernest J. Parry.
John C. Umney.

Holt, Fred, B.Sc.,

28, Mere Street, Rochdale.

Research Student. Studied Chemistry for three years in the University of Manchester. First Class Honours B Sc. Examination. Working in the Research Laboratories.

Harold B. Dixon. Alfred Holt, jun.
W. H. Perkin. Norman Smith.
A. Lapworth. Ch. Weizmann.

Knecht, Edmund, M.Sc. Tech. (Manch.) Ph.D.,

Municipal School of Technology, Manchester.

Professor of Technological Chemistry in the University of Manchester. Author of many papers in the *Berichte*, etc., on the Theory of Dyeing and on Analytical Chemistry.

Harold B. Dixon. R. Robinson.
W. H. Perkin. Ch. Weizmann.
Norman Smith. E. C. Edgar.
H. F. Coward. A. Lapworth.
Arthur W. Crossley.

Khan, Prince Mahmood Ali,

Zafermanzl, Rampur State, U.P., India,

Late Personal Assistant to H.H. the Nawab of Rampur. Chief Excise Officer. Chief Officer of Foreign Property. (1) B.A. Western University; (2) Diploma in Dairying, University College, Reading; (3) Diploma in Agriculture, University College, Reading; (4) B.D.F.A. Certificates in Butter and Cheese; (5) Desirous of keeping in touch with the advance of Chemical Science; (6) N.D.D. Royal Agricultural Society of England; (7) B.D.F.A. Diploma.

J. K. H. Inglis. J. W. Dodgson.
P. C. Austin. John W. Tayleur.
C. W. Walker-Tisdale.

Knight, William Arthur,

5, The Green, Marlborough.

Assistant Master at Marlborough College. M.A. Cantab.

F. Francis. Reginald G. Durrant.
F. W. Rixon. J. E. S. Tuckett.
Arthur W. Crossley.

Lambert, Bertram, M.A.,
34, Leckford Road, Oxford.

Lecturer and Demonstrator in Chemistry in the University Laboratories.

William Odling. Harold Hartley.
J. E. Marsh. John Watts.
D. H. Nagel. Allan F. Walden.
F. D. Chattaway.

Low, Kenneth Stewart,
3, Luxemburg Gardens, London, W.

Metallurgist and Assayer. Educated at St. Paul's School. First studied Chemistry at the S.W. Polytechnic—passed Sessional Examination and obtained Certificate of Merit; afterwards at Royal College of Science (passed Chemistry, Part I., theoretical and practical); and Royal School of Mines (Assaying and Metallurgy, theoretical and practical, Parts I. and II.); Associateship (Metallurgy, 1906). Assistant Assayer with Messrs. J. S. MacArthur & Co., Glasgow. Research Chemist with Messrs. C. Pass & Son, Bedminster Smelting Works, Bristol; and for the past three years Chief Chemist and Assayer to the Penhalonga Proprietary Mines, Ltd.

W. Gowland. G. T. Morgan.
F. W. Harbord. W. H. Merrett.
E. O. Courtman.

Lowe, Clement Ward,
Thorneyholme, Knutsford, Cheshire.

Manufacturing Chemist. Fellow of the Institute of Chemistry (1891). Member of the Society of Arts. Member of the Society of Chemical Industry. I studied Chemistry under Sir Henry Roscoe and the late Mr. Carl Schorlemmer at Owens College, Manchester, for a period of four or five years. During the latter part of the time I was occupied with original work, and acted as a private assistant to the late Mr. Schorlemmer. A paper by me on Dibenzyl Ether was published in the *Journal of the Chemical Society* about the year 1889. Since the death of my father, in 1898, who was one of the earlier Fellows of the Chemical Society, my time has been entirely devoted to the business of manufacturing chemist.

R. Le Neve Foster. Thomas Tyrer.
Watson Smith. *William Crookes.*
William Thomson.

MacGeorge, David Jackson,
Rangoon Refinery Co., Ltd., Thilawa, Burma.

Oilworks Chemist. Four years' training as a student-assistant in

Laboratory of Edinburgh City Analyst; three and a-half years assistant chemist in Scottish Shale Oil Works, Broxburn Oil Co., Ltd.; one year chief chemist Indo-Burma Petroleum Co., Burma; one year chief chemist and assistant manager, Rangoon Refinery Co., Ltd., Burma; am a member Edinburgh University Chemical Society.

J. Falconer King.	John M. Guthrie.
John S. Ford.	*G. H. Gemmell.*

J. Wyclif Black.

McNish, Malcolm,

Shortsands, St. Neots, Hunts.

Manufacturing Chemist. During the years 1906 and 1907 I studied the Chemistry of Fermentation at the University Chemical Laboratories, Cambridge, and during the years 1908 to 1910 I studied Analytical Chemistry as applied to the above in the laboratory of Mr. Chaston Chapman, 8, Duke St., London, E.C. During two years I have had practical experience in the manufacture of malt extract and other malt products in the works of Messrs. Paine & Co., Ltd., St. Neots, Hunts, and am now engaged in doing analytical work in that firm's laboratory.

Alf. Chaston Chapman.	Barth. F. Sawbridge.
Fred. T. Harry.	J. E. Purvis.

W. J. Sell.

Majima, Rikō,

37, Linden Garden, Notting Hill Gate, W.

Assistant Professor Chemical Institute, University, Tokio. Author of various papers published in *Berichte*; for example, on "Terpinen," on "Japanese Lack," etc., etc.

Alexander Scott.	Hugo Müller.
Edward Divers.	James Dewar.

James D. Kettle.

Masson, James Irvine Orme,

2, Chester Street, Edinburgh.

M.Sc. (Melbourne). Student of Chemistry. Formerly Lecturer on Chemistry in Ormond College (Univ. of Melb.); and Victorian Government Research Scholar in Chemistry. Now 1851 Exhibition Research Scholar. Publications:—"The Action of Water of Crystallisation on Calcium Carbide" (*J.C.S.*, *Trans.*, 1910, 851); "The Decomposition of Metallic Cyanates by Water" (jointly with Professor Masson) (*Z.P.C.*, lxx, 290).

James Walker.	Alex. C. Cumming.
Orme Masson.	Alex. Crum Brown.

William Ramsay.

Merton, Thomas R., B.Sc. (Oxon.).
18, Grosvenor Street, W.

Research Student, Balliol College, Oxford. Dissertation on the "Viscosity and Density of Solutions of Cæsium Nitrate."

John M. Thomson.
Herbert Jackson.
D. H. Nagel.
Harold Hartley.
N. Garrod Thomas.

Mitchell, Alec Duncan,
"Carnock," Hartley Road, Leytonstone.

Research Assistant. B.Sc. (London, 1908), First Class Honours; formerly Junior Demonstrator at East London College (Univ. of London); Research Assistant to Dr. J. F. Thorpe (Sorby Research Fellow in University of Sheffield); joint author of several papers in Journal of Society (1908, 842; 1909, 1430, 2198, and 1910, 997).

J. F. Thorpe.
W. Palmer Wynne.
J. T. Hewitt.
F. G. Pope.
Clarence Smith.
J. Kenner.
J. J. Fox.
H. V. Mitchell.

Mitra, Dhirendranath, B.A. Dip. in Agri. (Shibpur)..
89/2, Musjeed Bari Street, Calcutta.

Lecturer in Physics and Chemistry in the College of Physicians and Surgeons, Bengal, and in the Calcutta Medical School. Also Demonstrator in Chemistry, Metropolitan Institution, Calcutta. B.A. in B Course of the Calcutta University, and Agricultural Diploma holder (Shibpur).

Paul Brühl.
Bidhu Bhushan Dutt.
P. C. Râу.
Jatindranath Sen.
Jyoti Bhushan Bhaduri.

Moore, Harold,
84, Kalashnikoff Quay, St. Petersburg.

Post-graduate Student of the Municipal School of Technology, Manchester. B.Sc. Tech. (Manchester). Studied Applied Chemistry for three years at the Municipal School of Technology, Manchester (1906–1909). Also had one year's experience at Research under Professor Knecht.

Stanley J. Peachey.
F. S. Sinnatt.
E. L. Rhead.
H. F. Coward.
F. G. Richards.

Nair, Valliyil Govindan, B.A. (Madras), B.Sc. Tech. (Victoria),
223, Upper Brook Street, C-on-M., Manchester.

Student, School of Technology, Manchester. Student of the

Presidency College, Madras (India), from 1902 to 1904 under Prof. W. H. Wilson, Ph.D., F.I.C., F.C.S., and took the B.A. Degree in Chemistry in 1905. Worked in the Imperial Agricultural Research Institute, Pusa, India, from 1907 to 1908 under the Fibre Expert, R. S. Finlow, Esq. B.Sc., F.C.S., etc. Student of the School of Technology (Department of Applied Chemistry), Manchester, from 1908 onwards, and took the Degree of B.Sc. Tech. (Victoria) in July, 1910.

Jul. Hübner.
L. G. Radcliffe.
S. J. Peachey.
F. S. Sinnatt.
Jas. Grant.
F. G. Richards.

Myers, James Eckersley, B.Sc.,
"Acresfield," Gatley, Cheshire.

Research Student in the University of Manchester. Student for Three years in the Chemical laboratories of the University of Manchester. B.Sc. with First Class Honours in Chemistry. Engaged in Research.

Harold B. Dixon.
W. H. Perkin.
A. Lapworth.
Norman Smith.
Alfred Holt, jun.
Ch. Weizmann.
E. C. Edgar.

Newman, Sidney Herbert,
181, Brooke Road, Upper Clapton, N.E.

Research Chemist at the Royal College of Science. B.Sc. (London). Formerly Student at the East London College. Joint author of several papers in the Society's Journal.

M. O. Forster.
J. T. Hewitt.
Clarence Smith.
Frank G. Pope.
James C. Philip.
G. T. Morgan.

Paterson, John Hamilton,
Carmyle, Wellington St., Grimsby.

Teacher of Organic Chemistry, and Analyst in private practice. B.Sc. (Dun.), 1902; M.Sc. (Dun.), 1910, by research in Analytical Organic Chemistry. Work done consists of: (1) A method of estimating hydroxyl groups in organic compounds. (2) A method of determining acetic acid in commercial vinegar. (3) An apparatus for the combustion of volatile organic liquids. Recipient of the Saville Shaw Memorial Medal (1902) given by the Soc. of Chem. Ind. for work on selenium.

P. Phillips Bedson.
S. Hoare Collins.
J. A. Smythe.
Arthur Jaques.
A. Forster.

Pennington, Alfred John,

"Oakley," Fallowfield, Manchester.

Manufacturing Chemist. Author of "Mineral Waters and their Uses"; "The Practical Mineral Water Manufacturer"; "Notes on the Essential Oils of Commerce," etc., etc. Three years laboratory, James Audley, B.Sc., F.C.S. Two years laboratory, Idris & Co., Ltd., London. Ten years as Manufacturing Chemist, Bratby and Hinchcliffe, Ltd., Manchester, London, and Glasgow.

T. H. W. Idris. Herbert J. Gover.
James A. Audley. M. S. Pickering.
F. R. Stephens.

Posford, Benjamin Ashwell,

"Wood Dene," Kippington, Sevenoaks, Kent.

Analyst. Assistant in the laboratories of Percy Edgerton, Esq., 96, Cheapside, E.C., since 19th October, 1908.

Percy Edgerton. William Ramsay.
F. Mollwo Perkin. *John W. Heath.*
James D. Kettle.

Prasad, Hari,

97, Roseneath Road, Urmston, Manchester.

Bachelor of Arts of the Punjab University. Bachelor of Science of the Victoria University of Manchester. Student for two years in the Chemical Dept. of the University of Manchester.

Harold B. Dixon. E. C. Edgar.
W. H. Perkin. Alfred Holt, jun.
Norman Smith.

Ramsden, Frederick Valentine,

Alexandra Street, E. St. Kilda, Victoria.

Assayer. Student Assistant, H. W. Levy (10 months). Student Assistant, Mines Department Laboratory, Victoria (13 months). Assistant, H. W. Levy, F.C.S. (15 months). Assistant, Mines Department Laboratory (9 months). At present Assistant Assayer, Royal Mint, Melbourne.

Francis R. Power. Henry W. Levy.
Robert Law. *D. Avery.*
A. H. Jackson.

Ransome, Alfred Oswald,

"Beechwood," Greenock Road, Paisley.

Analytical and Works Chemist. Five years Analytical and Research Work, Oil Cloth manufacture. One and a-half years General Analytical

Research work. One year Works Chemist, Lubricating Oil Works. Two and a-half years at Works (Analytical and Research) and at Fish Oil Works (Refiners) as Head Chemist (present position).

John Stewart Remington.
George Frederick Wesley Martin.
T. Marshall Tyson.
Thomas Gray.
F. Henry Streatfeild.

Rees, Thomas John, B.A.(Cantab.), B.Sc.(Wales),
Cwmllynfell, Swansea Valley.

Graduate, Christ's College, Cambridge. Four years' experience in the University Laboratories, University College of Wales, Aberystwyth. Two years' experience in the University Laboratories, Cambridge. Late lecturer in Chemistry at the Technical School, Lowestoft.

H. J. H. Fenton.
W. J. Pope.
C. S. Gibson.
W. J. Sell.
A. E. Bellars.

Rele, Gangaram Rajendrarao,
18, Entwistle Street, Manchester.

Three years' study at the Victoria Jubilee Technical Institute, Bombay, of which I obtained the Diploma of L.T.M. Service as Sizing and Weaving Master in two of the Indian mills. Two years' study at the M.S.T., Manchester, in Applied Chemistry; obtained Certificate of the Victoria University.

Jul. Hübner.
S. J. Peachey.
L. G. Radcliffe.
F. S. Sinnatt.
Jas. Grant.

Ridgway, Joseph,
Rownall Hall, Wetley Rocks, Stoke-on-Trent.

Flour Miller. Cambridge Natural Sciences Tripos, Parts I and II, 1903 and 1904. Reason for desiring to become admitted: At present engaged in a manufacturing process in which Chemistry is beginning to play an active part.

J. E. Purvis.
W. J. Sell.
F. W. Dootson.
H. O. Jones.
H. J. H. Fenton.
T. B. Wood.

Robinson, James Beglar,
Kilmarnock Dairy School.

Student. Three years' Diploma in Agriculture as awarded by Armstrong College (Durham University). The course undertaken includes General Chemistry, particular importance being attached to Agricultural Chemistry—theoretically and practically.

P. Phillips Bedson. J. A. Smythe.
S. Hoare Collins. *R. A. Berry.*
H. H. Green.

Sen, Rajendra Nath,

41, Machnabazar Street, Calcutta, India.

Professor of Tinctorial Chemistry, Engineering College, Sibpur, Bengal, India. M.A. (Calcutta); M.Sc. (Leeds). Diploma holder in dyeing (Leeds); Silver medallist in cotton and wool dyeing (City and Guilds of London); Member of the Society of Chemical Industry; done some research work in Colour Chemistry under Prof. Green (papers to be soon published).

A. G. Green. Arthur Smithells.
J. B. Cohen. A. G. Perkin.
H. R. Procter.

Sharpe, Frederick Herbert,

The Ferns, Cressington Park, Liverpool.

Analytical Chemist. Assistant to Dr. Geo. Tate, Analyst, Liverpool, for 7 years. Assistant Teacher of Chemistry, Technical School, Liverpool, for 8 years.

George Tate. William Herbert Miles.
Thomas John Roberts. *Alfred Smetham.*
Frederick Robertson Dodd.

Smith, Percy Lancelot James,

Army College, Storrington, Sussex.

Army Tutor in Science. M.A., Oxon., Honours Chemistry. A.I.C., Branch E. (Food and Drugs). Science Master for past eleven years. 1903–1907, Chief Science Master, Blackburn Grammar School.

Alf. Chaston Chapman. A. Jaffé.
F. W. Richardson. W. W. Fisher.
Robert H. Pickard.

Smith, William James Pittock,

9, Meddowcroft Road, Gerard Road, Wallasey.

Creamery Manager. Student: connexion with Analytical Chemistry. As a student I attended a full course at the Midland Agricultural and Dairy College, Derby, and passed the Diploma Examination, which included Practical and Theoretical Chemistry and Bacteriology. I have also passed in Chemistry in the Lancashire and Cheshire Institutes Examination.

John Golding. C. W. Walker-Tisdale.
H. D. Richmond. *John W. Tayleur.*
Fredk. J. Lloyd.

Srivastava, Jwala Prasad,

20, Curzon Avenue, Victoria Park, Manchester.

For two years a Student under Prof. H. C. Chatterji, B.A., Christ Church College, Cawnpore; for one year a student under Dr. E. G. Hill, Muir Central College, Allahabad, and for two years a student at the Municipal School of Technology, Manchester, in Applied Chemistry, where I obtained the degree of B.Sc. Tech., First Class with Honours.

Jas. Grant. Stanley J. Peachey.
F. G. Richards. F. S. Sinnatt.
E. L. Rhead.

Temperley, Claude Vareille,

Trent College.

Senior Science Master. B.Sc. (Lond.). Student, Bonn and Manchester Universities. Wishes to keep in touch with chemical progress.

H. B. Dixon. Norman Smith.
W. H. Perkin. R. Robinson.
Ch. Weizmann. *A. Lapworth.*

Terrey, Augustus George,

47, Cann Hall Road, Leytonstone, Essex.

Chemist. Assistant to Messrs. Sanitas Co., Ltd., London (Disinfectant Manufacturers). Ex-student of the Leyton Technical Institution Science Classes. Student of Chemistry under W. Robins, B.Sc., F.I.C., and at Sir John Cass Technical Institute. Am anxious to have access to the Society's publications and Library.

Charles A. Keane. W. Gordon Carey.
H. Burrows. C. T. Kingzett.
R. C. Woodcock. *F. Henry Streatfeild.*

Turner, Joseph,

Azo House, Birkby, Huddersfield.

Chemist. Director of Messrs. Read Holliday & Sons, Ltd., Aniline Colour Manufacturers, Huddersfield.

R. Meldola. J. C. Cain.
G. T. Morgan. A. G. Green.
M. O. Forster.

Turbutt, Richard Babington,

Royal Artillery Mess, Woolwich.

2nd Lieutenant in the Royal Field Artillery. Honours in Natural Science (Chemistry Branch) in the Final School of Natural Science at Oxford University. Bachelor of Arts of the same University, and desirous of learning everything new in the manufacture of explosives, steel for guns, etc.

Henry A. Miers.	N. V. Sidgwick.
H. L. Bowman.	Andrea Angel.
D. H. Nagel.	H. B. Baker.

Wallis, Robert Lauder Mackenzie,

Llwyndu, Cardiff Road, Llanishen, S. Wales.

Lecturer in Chemical Physiology, University College, Cardiff. Late Scholar, Downing College, Cambridge. Investigations: "On Chylous and Pseudo-chylous Ascites, Part I.," *Quart. Journ. Med.* (Oxford), April, 1910. "The Effects of Electric Baths on the Excretion of Creatinin in the Insane," *Journ. Ment. Science*, April, 1910. "On the Chemical Changes in Milk, and their Relation to Epidemic Diarrhœa of Infants," *Local Government Board Report* (ready for publication). "On Chylous and Pseudo-chylous Ascites, Part II.," *Quart. Journ. Med.*, Sept., 1910. B.A. (Cantab).

H. O. Jones.	Robert D. Abell.
H. J. H. Fenton.	Claude M. Thompson.
H. Jackson.	F. G. Treharne.
W. D. Halliburton.	*Charles T. Heycock.*

Williams, Arthur Bernard,

Coychurch Rectory, Bridgend, S. Wales.

Analytical Chemist and Lecturer in Chemistry. Four years' experience as Assistant in Public Analysts' Laboratories. Five years' experience as Science Master in Public and Agricultural Schools. First Class in Chemistry in Science and Art Examination, etc., etc.

Rhys P. Charles.	Clarence A. Seyler.
E. Howard Tripp.	*George Embrey.*

Herbert Eccles.

Williams, Herbert Goulding,

Robert Gordon's College, Aberdeen.

Teacher. B.Sc. (Hon.) of London University. Head of Chem. Dept. and Teacher of Advanced Classes in Chemistry in the above Institution, having Adult Evening Classes and a Secondary Day School.

T. S. Murray.	F. R. Japp.
Charles E. Browne.	*E. W. L. Foxell.*

Edmund M. Rich.

Wright, William Norman Stewart,

26, Lansdowne Crescent, Glasgow, W.

Analytical Chemist. Student under Dr. Clark, City Analyst, 138, Bath Street, Glasgow, also at the Glasgow and West of Scotland Technical College. Chemist to the British Boiler Cleaning and Enamelling Co., 201, Stobcross Street, Glasgow.

Thomas Gray.
G. G. Henderson.
R. R. Tatlock.
R. T. Thomson.
A. B. Steven.

Yusuf, Syed Muhammad,

Chemistry Department, School of Technology, Manchester.

Student at Municipal School of Technology, Manchester. Three years' Course in Chemistry at M. A. O. College, Aligarh (India), and two years at the Engineering College, Roorkee (India). Two years' Day Course at the School of Technology (Manchester), at the end of which obtained degree of B.Sc. Tech. in Applied Chemistry from Manchester University.

Jul. Hübner.
E. L. Rhead.
F. S. Sinnatt.
Jas. Grant.
F. G. Richards.
S. J. Peachey.

The following Certificates have been authorised by the Council for presentation to Ballot, under Bye-law I (3):

Cram, Marshall Perley,

Brunswick, Maine, U.S.A.

Asst. Prof. of Chemistry in Bowdoin College, and lecturer in the Maine Medical School. Received the degrees of A.B. in 1904 and A.M. in 1905 from Bowdoin College, and of Ph.D. in 1908 from the Johns Hopkins University. At present head of the department of Chemistry in Bowdoin College. Published, with J. Bishop Tingle, "Preparation of the Aniline Derivatives of Phthalic Acid and of Succinic Acid" (*Am. Chem. J.*, **37**, 596); with J. Elliott Gilpin, "The Fractionation of Crude Petroleum by Capillary Diffusion" (*U.S. G. S. Bull.*, **365**).

Ira Remsen.
J. Bishop Tingle.
W. R. Lang.
Alexander Smith.

Crichton, Charles,

Afrikander Mine, Klerksdorp, Transvaal.

Analytical Chemist. Four years' experience with F. Jobson, Esq., F.I.C., Sheffield; two years in charge of laboratory at Sheffield Test and Experimenting Works, and five years Chief Assayer to Kleinfontein Group of Mines. At present Cyanide Works Manager and Assayer to the Afrikander Prop'ty Mines, Ltd., Klerksdorp.

J. K. Erskine.

Gramont, Count Arnaud de,

Rue de l'Université, 49, Paris.

Distinguished as a spectroscopist. Has contributed many memoirs to scientific journals.

William Ramsay. L. Troost.
A. Haller. Th. Schlœsing.
Armand Gautier. H. Le Chatelier.
L. de Boisbaudran.

Leechman, Alleyne,

Government Laboratory (55 Main Street), Georgetown, British Guiana.

Science Lecturer, Department of Science and Agriculture, British Guiana. Having been a Natural Science Scholar of Corpus Christi College, Oxford, and manufacturing chemist in the employ of the Australian Drug Co., Ltd., Sydney, N. S. Wales, and now holding the post of Science Lecturer, I am anxious to keep in touch with recent developments of Chemical Science.

J. B. Harrison. Jno. Williams.
E. P. Minett.

Tschugaeff, Leo,

St. Petersburg.

Professor of Chemistry at the University of St. Petersburg. The principal investigations of L. Tschugaeff concern the following questions of scientific chemistry: (1) the optical activity of organic bodies; (2) the chemistry of terpens and camphor derivatives; (3) the chemistry of cobaltammines and other complex compounds, and (4) tribolumineiscence.

Svante Arrhenius. William Ramsay.

Vance, John Fleming Culun Brown,

947, Richard St., Vancouver, B.C., Canada.

Public Analyst for the Corporation of the City of Vancouver. Appointed May 1st, 1907. Hold British Columbia Government Certificate for Efficiency in Assaying and Analytical Chemistry. Member of the Canadian Mining Institute. Chief Metallurgist to the Kamloops Mines, Ltd. (from Sept., 1904, to Sept., 1906), Kamloops, B.C.

J. O'Sullivan. J. P. Wright.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY SUFFOLK.

Issued 13/12/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 378.

Thursday, December 1st, 1910, at 8.30 p.m., Professor **Harold B. Dixon**, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. F. S. Long and Horace Finnemore were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Albert Ashe, Laurie Square, Romford.
Morris Cutner, B.Sc., 21, Bairstow Street, Preston.
James Edward A. Devlin, Marist Brothers College, Uitenhage, Cape Colony.
William Temple Gardner, Bruern, Alexandra Road, Upper Parkstone.
Harold James Page, Avondale, Meteor Road, Westcliff-on-Sea.
Robert Viner Stanford, M.Sc., Ph.D., Cardiff City Mental Hospital, Whitchurch, Glam.

A ballot for the election of Fellows was held, and the following were declared duly elected:

Malcolm Percival Applebey.
Manindranath Banerjee.
Fred Wilkinson Barwick.
Sarat Chandra Bhattacharya, M.A.
Stewart McGregor Bosworth, B.Sc.
André Bracher.
Frederick Hugh Rochfort Brady.
John C. Briggs.

Henry Vincent Aird Briscoe, B.Sc.
John Brown, B.Sc.
Bertram Hayward Buttle.
Frank Anthony Camp.
Frederick Challenger, B.Sc.
Reginald Thomas Colgate.
Thomas Watts Coslett.
Marshall Perley Cram, A.M., Ph.D.
David Chalmers Crawford, M.A., B.Sc.
Charles Crichton.
John Hughes Davies, B.Sc., Ph.D.
Arthur Dodd.
James Hugh Duncan.
William Gidley Emmett, B.A.
Ainslie Jackson Ensor, B.Sc.
John George Finlayson, B.A.
George Alexander Goddon.
Count Arnaud de Gramont.
Fred. Holt, B.Sc.
Prince Mahmood Ali Khan, B.A.
Edmund Knecht, M.Sc., Ph.D.
William Arthur Knight, M.A.
Bertram Lambert, M.A.
Alleyne Leechman.
Kenneth Stewart Low.
Clement Ward Lowe.
David Jackson MacGeorge.
Malcolm McNish.
Rikō Majima.
James Irvine Orme Masson, M.Sc.
Thomas R. Merton, B.Sc.
Alec Duncan Mitchell, B.Sc.
Dhirendranath Mitra, B.A.
Harold Moore, B.Sc.
James Eckersley Myers, B.Sc.
Valliyil Govindan Nair, B.A., B.Sc.
Sidney Herbert Newman, B.Sc.
John Hamilton Paterson, M.Sc.
Alfred John Pennington.
Benjamin Ashwell Posford.
Hari Prasad, B.A.
Frederick Valentine Ramsden.
Alfred Oswald Ransome.
Thomas John Rees, B.A., B.Sc.
Gangaram Rajendrarao Rele.
Joseph Ridgway, B.A.
James Beglar Robinson.
Rajendra Nath Sen, M.A., M.Sc.
Frederick Herbert Sharpe.
Percy Lancelot James Smith, M.A.
William James Pittock Smith.
Jwala Prasad Srivastava, B.Sc.
Claude Vareille Temperley, B.Sc.
Augustus George Terrey.
Leo Tschugaeff.
Richard Babington Turbutt, B.A.
Joseph Turner.
John Fleming Culun Brown Vance.
Robert Lauder Mackenzie Wallis, B.A.
Arthur Bernard Williams.
Herbert Goulding Williams, B.Sc.
William Norman Stewart Wright.
Syed Muḥammad Yusuf, B.Sc.

Of the following papers, those marked * were read:

*321. "The triazo-group. Part XV. Triazoethylene (vinylazoimide) and the triazoethyl halides." By Martin Onslow Forster and Sidney Herbert Newman.

Triazoethylene (*vinylazoimide*), $CH_2{:}CHN_3$, prepared by the action of hot alcoholic potassium hydroxide on triazoethyl bromide or iodide, is a pale yellow liquid, boiling at 26°/760 mm. The dibromide is rapidly decomposed by cold water, yielding bromoacetaldehyde with hydrazoic and hydrobromic acids.

β-Chloro-α-triazoethane (*triazoethyl chloride*), $N_3{\cdot}CH_2{\cdot}CH_2Cl$, obtained from triazoethyl iodide by heating it with mercuric chloride, boils at 45°/25 mm., and has D^{24} 1·2885. *β-Bromo-α-triazoethane* (*triazoethyl bromide*), $N_3{\cdot}CH_2{\cdot}CH_2Br$, arising from triazoethyl alcohol and phosphorus tribromide, boils at 49°/20 mm., and has D^{19} 1·6675. *β-Iodo-α-triazoethane* (*triazoethyl iodide*), $N_3 \cdot CH_2 \cdot CH_2I$, produced when a solution of sodium iodide in dry acetone acts on the foregoing substance, boils at 68°/20 mm., and has D^{25} 1·9154.

β-Triazoethyl ether, $N_3 \cdot CH_2 \cdot CH_2 \cdot O \cdot C_2H_5$, is the result of heating triazoethyl alcohol with ethyl iodide and dry silver oxide; it boils at 49°/25 mm., and has D^{24} 0·9744.

DISCUSSION.

The PRESIDENT asked Dr. Forster whether he had attempted to heat the vapour of triazoethylene, and, if so, whether it had exploded.

Dr. T. CALLAN inquired whether the authors had tried the action of silver azide on triazoethyl iodide with a view to obtaining, by simple replacement of the iodine by the triazo-group, a compound with two triazo-groups in the molecule.

Dr. FORSTER stated that the vapour of triazoethylene had not been heated; nor had any attempt been made to effect interaction between triazoethyl iodide and silver azide, because the symmetrical bistriazoethane which should arise could be prepared by a more simple process, and had already been examined.

*322. "The dinitro-derivatives of dimethyl-*p*-toluidine." By Gilbert T. Morgan and Arthur Clayton.

Although dimethyl-*p*-toluidine, when nitrated in concentrated sulphuric acid solution, yields only 2-nitrodimethyl-*p*-toluidine, yet when the nitration mixture is poured into water so that the temperation rises to 40°, the reaction proceeds a stage further, and 2 : 5-dinitrodimethyl-*p*-toluidine (m. p. 103—104°) is produced. The position assumed by the second nitro-group in this compound was ascertained in the following manner.

2-Nitrodimethyl-*p*-toluidine, when reduced and acetylated, yielded 2-acetyl-4 : 4-dimethyl-2 : 4-diaminotoluene, which, on nitration, gave 5-*nitro-2-acetylaminodimethyl*-p-*toluidine*. On reduction, this nitro-compound furnished 2-*acetyl*-2 : 5-*diaminodimethyl*-p-*toluidine*, which, by the agency of the Sandmeyer reaction, gave rise to 5-bromo-2-acetylaminodimethyl-*p*-toluidine, the constitution of which has already been determined.

The foregoing 2-acetyl-2 : 5-diaminodimethyl-*p*-toluidine was converted into 2 : 5-diacetyldiaminodimethyl-*p*-toluidine, which can also be prepared by reducing 2 : 5-dinitrodimethyl-*p*-toluidine and acetylating the resulting 2 : 5-diaminodimethyl-*p*-toluidine, thus demonstrating the position of the second nitro-group in 2:5-dinitrodimethyl-*p*-toluidine. 2:6-*Dinitrodimethyl*-p-*toluidine* (m. p. 192°), was prepared by the action of methyl sulphate on 2:6-dinitro-*p*-toluidine.

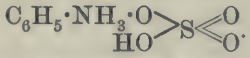
DISCUSSION.

Dr. FLÜRSCHEIM mentioned that Crum Brown and Gibson's rule, which did not profess to explain the directing influences in the benzene nucleus, had also ceased to correspond with facts (compare *J. pr. Chem.*, 1902, [ii], **66**, 322). He had also proved that the alternate hypothesis advocated by Dr. Morgan—the prevention of ortho-para-substitution by the negativity of a substituent—also did not agree with facts (compare *J. pr. Chem.*, 1902, [ii], **66**, 329; 1905, [ii], **71**, 500).

On the other hand, he had himself suggested a solution based on the varying strength of "single" bonds (compare *loc. cit.*, and *J. pr. Chem.*, 1907, [ii], **76**, 197, for directing influence of methyl; also *Ber.*, 1906, **39**, 2015), and this had been borne out by every observed fact. The sole exception had hitherto been Dr. Morgan's suggestion (*Proc.*, 1910, **25**, 82) that, in dilute acid, a second nitro-group entered 2-nitrodimethyl-*p*-toluidine and possibly in the 6-position. The experimental decision had been left to him and Mr. Clayton, and their results had vindicated his (the speaker's) theory.

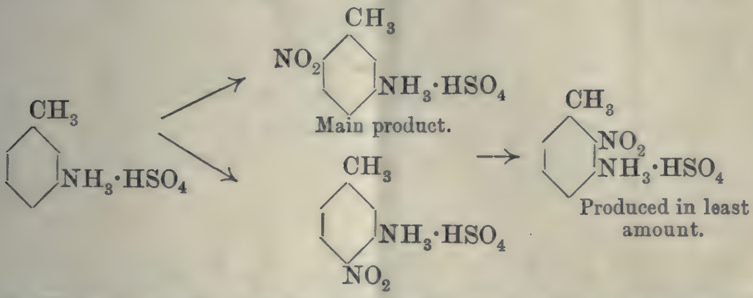
Dr. MORGAN, in reply, said that they regarded the nitration phenomenon from a mechanical standpoint, based on the Pope and Barlow theory of the configuration of benzene, whereas Dr. Flürscheim, in looking at the matter rather from the point of view of Kekulé's benzene formula, laid too much stress on the connexion between unsaturation of the substituent radicle and its power of inducing ortho-para-substitution. But although the unsaturated groups, NH_2, OH, etc., induced substitution in the ortho-para-positions, yet the methyl radicle did the same, and the latter group could not fairly be assumed to possess much residual affinity.

On the other hand, he regarded the groups, $-NH_3\cdot HSO_4$, $-NH_2R\cdot HSO_4$, and $-NHR_2\cdot HSO_4$, present when aromatic amines were nitrated in concentrated sulphuric acid, as being distinctly unsaturated complexes owing to the presence of double linkings in the sulphate group:



$$C_6H_5\cdot NH_3\cdot\begin{matrix}O\\HO\end{matrix}\!>\!S\!<\!\begin{matrix}O\\O\end{matrix}.$$

Nevertheless, these complexes did not usually induce substitution in ortho-para-positions, but in meta-positions. Where the latter positions were not assumed, as in the case of *m*-toluidine, the exceptional orientation could be traced to the influence of other substituents (Noelting and Stoecklin, *Ber.*, 1891, **24**, 564):



In this nitration, the nitro-groups took up the positions they would assume even in the absence of the $NH_3 \cdot HSO_4$ radicle, this result indicating that the directive (attractive) influence of the saturated methyl group prevailed over the influence of the sulphate complex, the repulsive effect of which was observed only in the fact that 6-nitro-*m*-toluidine was the chief product.

*323. "Experiments on the Walden inversion. Part VI. Conversion of the optically active α-hydroxy-α-phenylpropionic acids into α-chloro-α-phenylpropionic acids." By Alex. McKenzie and George William Clough.

The authors find that thionyl chloride and phosphorus pentachloride behave differently towards *l*-α-hydroxy-α-phenylpropionic acid, inasmuch as the former gives *l*-α-chloro-α-phenylpropionic acid, whereas the latter gives *d*-α-chloro-α-phenylpropionic acid. The action of thionyl chloride and of phosphorus pentachloride on optically active ethyl α-hydroxy-α-phenylpropionate has also been examined.

324. "The auto-reduction of hydrazines."

By Frederick Daniel Chattaway and Montague Aldridge.

Aromatic hydrazines, when heated, undergo simultaneous oxidation and reduction, whereby an amine, ammonia, nitrogen, and a hydrocarbon are produced, according to the equation: $2R \cdot NH \cdot NH_2 = RNH_2 + NH_3 + N_2 + RH$.

The reaction is a general one, and, in the case of unsubstituted primary hydrazines, such as phenylhydrazine, the tolylhydrazines, and the naphthylhydrazines, takes place quantitatively. It proceeds slowly even at the boiling temperature, the rate increasing rapidly as the boiling point of the hydrazine is approached. It is thus impossible to obtain any hydrazine in a state of purity by distillation.

The slow decomposition which hydrazines undergo on keeping, even when air is excluded, is due to this auto-reduction.

In the case of hydrazines containing a substituted aromatic residue, although this primary decomposition takes place to a considerable extent, other reactions may also occur on heating, especially at a high temperature, due to the presence of the substituting atoms or groups.

325. "The activity of acids as catalysts in relation to the nature of the solvent medium." By Harry Medforth Dawson.

The influence of the nature of the solvent on the rate of the tautomeric change of acetone, in presence of sulphuric acid as a catalyst, has been investigated in alcohol–water mixtures ranging from pure water to anhydrous alcohol. It is found that the velocity of the tautomeric change is nearly independent of the composition of the solvent if this contains less than about seventy volumes per cent. of ethyl alcohol. As the proportion of alcohol is increased, the reaction velocity increases, slowly at first, but afterwards more and more rapidly, until in anhydrous alcohol the speed is more than one hundred times as great as it is in aqueous solution. The large changes in velocity are probably due to changes in the catalytic activity of the acid in the different solvents. Although the velocities in alcohol and in water differ to such a very large extent, the concentrations of the positive acid ions in equimolar acid solutions appear to be very nearly equal, and it is supposed that the actual catalyst is represented by free hydrogen ions, which, however, in consequence of their relatively small concentration, play only a subsidiary part in connexion with the electrical conductivity of the solutions.

326. "The volume of a solute in solution." By Dan Tyrer.

The volume changes which occur on the dissolution of a solute have been measured, and the specific solution volume of the solute has been calculated by means of the equation:

$$v = \frac{(100 + A)S_1 - 100S_0}{A},$$

where v is the specific solution volume, or the change in volume caused by the dissolution of 1 gram of the solute, A the percentage concentration of the solution, S_1 the specific volume of the solution, and S_0 that of the pure solvent. The values of S_1 and the values of v, calculated according to the above equation, have been determined for a large number of solutions of various solutes and solvents by means of the dilatometer and pyknometer.

Normal organic solutes and solvents have been used to avoid complications through molecular association or dissociation. It has been found that (1) the specific solution volume is, in most cases, constant and quite independent of the concentration, (2) the specific solution volume of the solute varies but slightly from solvent to solvent.

The cause of the variations with change of solvent was discussed, and the hypothesis was put forward that through an increase or decrease in the molecular attraction between the molecules of solvent and solute, a contraction or expansion of the solvent occurs, causing a variation in the calculated specific volume of the solute in solution.

327. "The absorption spectra of some derivatives and isomerides of 1 : 2-diketo-Δ^3-*cyclo*pentene." By John Edward Purvis.

The results of this investigation show that (1) the colour is determined primarily by the monoketonic and diketonic structures; (2) the absorption in the more refrangible regions of the monoketonic compounds is determined by the type of ring in which the ketonic structure occurs; (3) in the diketonic compounds the colour is modified in the direction of the more refrangible regions by the introduction of an oximino- or $\colon N{\cdot}NHPh$ group, a result analogous to that previously observed in diketopyrrolines; (4) in the diketonic compounds the absorption of the phenylhydrazone or of the *iso*phenazine derivative is wholly different from that of the corresponding substances derived from the diketopyrrolines; (5) the difference in the *iso*phenazine compound and in a bluish-coloured sodium derivative of 1 : 2-diketo-Δ^3-*cyclo*pentene is explained as the result of changes in the positional valencies of the ring.

328. "4-β-Aminoethylglyoxaline (β-iminazolylethylamine) and the other active principles of ergot." By George Barger and Henry Hallett Dale.

The identification of an ergot base having a very powerful action on the isolated uterus as 4-β-aminoethylglyoxaline (β-iminazolylethylamine) (this vol., p. 128) has been completed by analysis of the dipicrate, and by a comparison of physiological properties. The method of isolation was described in detail.

329. "Synthesis of camphoric acid." By Gustav Komppa.

Although Thorpe (*Proc.*, 1909, **25**, 94) was able to obtain only a 10 per cent. yield of methyl diketo*apo*camphorate, three of the author's assistants have obtained yields varying from 45 to 70·5 per cent.

From the methylated ester, which Blanc and Thorpe (*Trans.*, 1910, **97**, 836) state to be the *O*-methyl ether, the author has now prepared, for the fifth time, *r*-dehydrocamphoric acid, and from this has obtained *r*-camphoric acid.

The author maintains the constitution previously assigned by him to methyl diketocamphorate, and shows that the methyl group in question must be attached to carbon and not to oxygen, as boiling hydriodic acid (Zeisel) fails to remove it.

330. "Viscosity and association. Part I. Association of the phenols." By Ferdinand Bernard Thole.

The viscosities of a number of phenols and their derivatives have been measured both in the pure state and in solution. From the results, the following conclusions have been drawn:

(1) The results obtained by the viscometric method agree very closely with those derived from other physical constants, such as vapour pressure, dielectric constant, molecular surface energy, molecular refractivity, and molecular weight determined cryoscopically.

(2) The viscosity determinations, using $\frac{\eta}{\text{mol. vol.}} \times 10^6$ as a criterion of association, show that phenols are associated, the ortho-compounds to the least, and the para-compounds to the greatest, extent. The ethers are not associated, but the acetates show slight association.

(3) The carbethoxyl, aldehyde, nitro- and halogen groups exert a marked inhibitive influence on association. Alkyl groups exert only a slight influence. Since the degree of inhibition of association appears to be intimately connected with the degree of unsaturation of the substituent, it is suggested that the depression of association is partly due to an attraction between the latent valency of the hydroxylic oxygen and the unsaturated substituent, the consequence being a diminution of the tendency to form complexes through the latent valency of the hydroxyl group. The same hypothesis explains the gradual disappearance of the characteristic reactivity of the carbonyl group in the series acetone–ethyl acetate–acetic acid.

(4) Solution in even a comparatively non-dissociating solvent, such as amyl acetate, produces considerable disruption of the molecular aggregates. In a dissociating solvent, such as ethyl alcohol, the dissociation is practically complete.

331. "Compounds produced by the simultaneous action of nitrites and hyposulphites on nickel salts. A method for the detection of nickel in presence of much cobalt." (Preliminary note.) By Walter Craven Ball.

When solutions of sodium or potassium nitrite and nickel nitrate are mixed, and sodium hyposulphite is gradually added, the liquid assumes the colour of a permanganate solution, and needle-shaped, dark purple crystals separate. This substance, of which the formula is possibly $Na_3NiNS_2O_8,4H_2O$, seems to be the sodium salt of a complex acid containing nickel. The potassium salt, similar in colour, but more soluble, may be obtained by a slight modification of the method. Both salts yield purple precipitates with barium and strontium solutions. Similar complex cyanides, of an intense reddish-purple colour, may be obtained by treatment of the above substances with potassium cyanide, and also by the oxidation of ammoniacal solutions of hydroxylamine, containing a nickel salt and a cyanide. They are soluble in alcohol and other organic solvents, and afford a ready means of detecting nickel in presence of much cobalt.

The compounds are all very unstable, and from their method of preparation would appear to be derived from some compound intermediate between nitrous acid and hydroxylamine, possibly from dihydroxylamine.

ADDITIONS TO THE LIBRARY.

I. *Donation.*

Fenton, *Henry John Horstman*. Outlines of chemistry. With practical work. Part I. 2nd edition. pp. xviii + 415. Cambridge 1910. (*Recd.* 5/12/10.) From the Author.

II. *By Purchase.*

Buchner, *Georg*. Die Metallfärbung und deren Ausführung mit besonderer Berücksichtigung der chemischen Metallfärbung. 4th edition. pp. xvi + 397. Berlin 1910. (*Recd.* 28/11/10.)

Koerner, *Wilhelm*. Ueber die Bestimmung des chemischen Ortes bei den aromatischen Substanzen. Translated and edited by *G.* **Bruni**

and *B. L.* **Vanzetti.** (Ostwald's *Klassiker*, No. 174.) Leipzig 1910. (*Recd.* 10/12/10.)

Lomonossow, *M. W.* Physikalisch-chemische Abhandlungen, 1741–1752. Edited by *B. N.* **Menschutkin** and *Max* **Speter.** (Ostwald's *Klassiker*, No. 178.) Leipzig 1910. (*Recd.* 10/12/10.)

Rechenberg, *C. von.* Theorie der Gewinnung und Trennung der Aetherischen Oele durch Destillation. pp. xii + 259 to 751. [Supplement to **Gildemeister,** *E.*, and **Hoffman,** *Fr.*, "Die aetherischen Oele."] Leipzig 1910. (*Recd.* 28/11/10.)

Woker, *Gertrud.* Die Katalyse. Die Rolle der Katalyse in der analytischen Chemie. I. Allgemeiner Teil. (Die chemische Analyse, Vol. XI and XII.) Stuttgart 1910. (*Recd.* 9/12/10.)

III. *Pamphlets.*

Siegrist, *H.* De la constitution de quelques dérivés iodés. (From the *J. Suisse Chim. Pharm.*, 1910, **48.**)

Studzinski, *J.* Ueber die giftigen Eigenschaften des Blutes. (From the *Zentr. Physiol.*, 1910, **23.**)

Tassilly, *E.* L'essence d' Ylang-Ylang de la Réunion. (From the *Bull. Sci. Pharm.*, 1910, **17.**)

Thunberg, *Torsten.* Studien über die Beeinflussung des Gasaustausches des überlebenden Froschmuskels durch verschiedene Stoffe. (From the *Skand. Arch. Physiol.*, 1909, **23.**)

Thunberg, *T.* Ueber katalytische Beschleunigung der Sauerstoffaufnahme der Muskelsubstanz. (From the *Zentr. Physiol.*, 1910, **23.**)

Waidner, *C. W.*, and **Burgess,** *G. K.* Note on the temperature scale between 100° and 500° C. (From the *Bull. Bureau of Standards*, 1910, **7.**)

Walter, *E.* Ueber die Verwendung des Benzidins für den Blutnachweis, im besonderen über seine Anwendungsweise in der gerichtsärztlichen Praxis. (From the *Deut. Med. Woch.*, 1910.)

Walpole, *George Stanley.* A method of titrating physiological fluids. (From the *Proc. Physiol. Soc.*, 1910; *J. Physiol.*, **40.**)

Wielen, *P. Van der.* Dosage de la morphine, de la narcotine et de la codéine dans l'opium et dans les préparations galéniques de l'opium. (From the *Bull. Sci. Pharm.*, 1910, **17.**)

ERRATUM.

PROCEEDINGS, 1910.

Page	Line	
268	20	*for* "ethyl" *read* "othyle."

At the next Ordinary Scientific Meeting on **Thursday**, December 15th, 1910, at **8.30** p.m., the following papers will be communicated:

"Studies on enzyme action. Part XV. The comparative influence of monohydric C_nH_{2n+1} alcohols and other non-electrolytes on enzymic activity." By H. E. Armstrong and E. F. Armstrong.

"Studies on enzyme action. Part XVI. The enzymes of emulsin (II). Prunase." By H. E. Armstrong, E. F. Armstrong, and E. Horton.

"Studies on enzyme action. Part XVII. The enzymes of emulsin (III). The probable seat of origin of amygdalin." By H. E. Armstrong, E. F. Armstrong, and E. Horton.

"Studies on enzyme action. Part XVIII. Enzymes of the emulsin type (II). The distribution of β-glucases in plants." By H. E. Armstrong, E. F. Armstrong, and E. Horton.

"Studies on enzyme action. Part XIX. Enzymes of the emulsin type (III). Linase." By H. E. Armstrong and J. V. Eyre.

"The interaction of alloxan and glycine." By W. H. Hurtley and W. O. Wootton.

"Traube's molecular-volume method applied to binary mixtures of organic substances." By W. R. G. Atkins.

"Investigations on the dependence of rotatory power on chemical constitution. Part I. The rotations of the simplest secondary alcohols of the fatty series. By R. H. Pickard and J. Kenyon.

"Oxycodeine. A new alkaloid from opium." By J. J. Dobbie and A. Lauder.

"Studies in the carbazole series." By C. Schwalbe and S. Wolff.

"Syntheses with phenol derivatives containing a mobile nitro-group. Part III. Complex iminazoles, azo-compounds, and azides." By R. Meldola and H. Kuntzen.

"The chemistry of mesothorium." By F. Soddy.

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Issued 30/12/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 379.

Thursday, December 15th, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society in the death of Prof. Dr. Rudolph Fittig on November 19th, and stated that the following telegram of condolence had been forwarded to Herr Fittig:

"The President, Officers, and Council of the Chemical Society deeply mourn the loss of their distinguished Honorary and Foreign Member, Professor Dr. Rudolph Fittig.—HORACE T. BROWN, Foreign Secretary."

It was announced that the Faraday Lecture would be delivered by Professor Theodore W. Richards on June 14th, 1911.

Messrs. H. V. A. Briscoe, H. Leslie F. Buswell, Rikō Majima, A. D. Mitchell, and Sidney H. Newman were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

James Allan, M.A., B.Sc., Ravenscourt, Lerwick, Shetland Isles.
Joseph Bate, 59, Southwood Lane, Highgate, N.
Joseph Mayson Blackburn, 346, Deane Church Lane, Bolton.
Michael Angelo Fielding, 8, St. Joseph's Place, Cork.

Evan Dalton Griffiths, B.Sc., 9, Wanstead Park Avenue, Manor Park, E.
Arthur Bennett Hall, 31, Dyer Street, Kirkham.
Charles Herbert Hampshire, B.Sc., 19, Brook Street, Ilkley.
Bernard Grindrod Hough, The Chestnuts, Wardle Road, Sale.
Ernyst Graham Laws, B.A., Alverna, Edith Road, Ramsgate.
Ian Gordon Sellar Wink, 27, Panmuir Road, Cottenham Park, Wimbledon, S.W.

Of the following papers, those marked * were read:

***332. "Studies on enzyme action. Part XV. The comparative influence of monohydric (C_nH_{2n+1}) alcohols and other non-electrolytes on enzymic activity." By Henry E. Armstrong and Edward Frankland Armstrong.**

The influence exercised by a number of non-electrolytes in several cases of enzymic change was considered from the point of view of the influence of molecular weight in modifying activity in the case of related compounds.

***333. "Studies on enzyme action. Part XVI. Prunase and amygdalase: their separate occurrence in plants." By Henry E. Armstrong, Edward Frankland Armstrong, and Edward Horton.**

It has been argued in former communications that the hydrolysis of amygdalin by almond emulsin is effected in several stages by distinct enzymes, the contention being that it is first resolved into a molecule of glucose and Fischer's glucoside by the action of amygdalase, Fischer's glucoside being then resolved into glucose and mandelonitrile by the agency of a second enzyme. Sources of the latter enzyme, in which it is unaccompanied by amygdalase, were indicated.

Evidence was adduced from which it was inferred that amygdalin is usually formed in the fruit, probably from Fischer's glucoside formed in the leaves.

***334. Studies on enzyme action. Part XVII. The distribution of β-glucases in plants." By Henry E. Armstrong, Edward Frankland Armstrong, and Edward Horton.**

A general method of studying the enzymes in plants was described and examples were given of its application.

*335. "Studies on enzyme action. Part XVIII. Linase." By Henry E. Armstrong and John Vargas Eyre.

Further examples were given of the application of the method lescribed in Part XVII to more than a dozen species of *Linum*; he experiments have been carried out with the object of studying the nzyme characteristic of this family.

Discussion.

Dr. Russell pointed out that some of the leguminous plants nentioned by Professor Armstrong as being rich in glucoside-plitting enzymes were also known to undergo very rapid fernentation in the animal stomach, which seemed to indicate high nzymic activity in other directions also. He further asked what vas the function of the hydrolytic products of the glucosides, and vhether it was possible that some of them might act in the plant n the same way as hormones acted in the animal, by controlling ertain of the processes going on. When, for example, the reproluctive processes began in the plant there set in an alteration in he type of changes taking place, vegetative growth giving place to eed formation. The mechanism bringing about this alteration in he case of animals could hardly be assumed in the case of plants, ut it was conceivable that some of the bodies Professor Armstrong ad described might be effective.

In answer to Mr. Hall, Professor Armstrong said that the mount of enzyme present in the organs of a plant was undoubtedly lifferent at different seasons, and it would be necessary to study lants over the whole period of growth.

In answer to Dr. Russell, he said that they had been led to onclude that glucosides were not so much reserve food materials n the ordinary sense of the term, or protective agents, but that, in nany cases, the significant constituent exercised a function in the lant similar to that which it exercised when present in human food—hat is to say, they served to stimulate enzymic change. It was n interesting fact that seeds of plants rich in glucoside often erminated with extreme readiness, the plant also growing rapidly, s in the case of mustard, for example. The change involved in he ripening of seeds might well be hastened by the rapid separation f hydrogen cyanide, for example, from a cyanophoric glucoside owards the close of the period of growth. The final disappearance f the cyanide from linseed and from vetch seeds was perhaps to e explained in this way. In the case of the banana, the unripe reen pod blackened rapidly under the influence of anæsthetics; in he natural ripening process, this change was determined from within the fruit by the liberation of a fruit ether (ethereal salt), and the outward blackening was thus a signal of the completion of inward change.

*336. "Investigations on the dependence of rotatory power on chemical constitution. Part I. The rotations of the simplest secondary alcohols of the fatty series." By Robert Howson Pickard and Joseph Kenyon.

The resolution of the inactive forms and determinations of the rotatory powers at different temperatures and other properties of the optically active forms of the following alcohols were described: methylethylcarbinol, methyl-*n*-propyl-, methyl-*n*-butyl-, methyl-*n*-amyl-, methyl-*n*-hexyl-, methyl-*n*-heptyl-, methyl-*n*-octyl-, methyl-*n*-nonyl-, methyl-*n*-decyl-, methyl-*n*-undecyl-, ethyl-*n*-hexyl-, methyl*iso*butyl-, phenylmethyl-, and phenylethyl-carbinols.

*337. "The chemistry of mesothorium." By Frederick Soddy.

Experiments on the mixture of radium and mesothorium with barium sulphate, obtained by adding a barium salt and sulphuric acid to a solution of thorianite in nitric acid, have shown that the separation of mesothorium is not due, as previously has been supposed, to its adsorption by the barium sulphate, but depends on a true chemical analogy between mesothorium and barium of the same kind as exists between barium and radium. The mesothorium could not be concentrated from the barium by chemical methods. By fractional crystallisation of the chlorides, the mesothorium remains with the radium, and can thus be separated from the barium. The proportion between mesothorium and radium is completely unchanged by fractional crystallisation of the chlorides. In the ordinary method used in the manufacture of thorium compounds for dissolving monazite sand, by heating it with excess of sulphuric acid and agitating the product with water, some of the mesothorium remains in the insoluble residue, but the greater part passes into solution. If a small quantity of a barium compound is mixed with the monazite sand before treatment, practically the whole of the mesothorium is separated with the insoluble residue, none passing into the solution. The part of the residue containing the mesothorium can readily be separated from the heavy unattacked sand by decantation. From this part the mesothorium can be separated by methods similar to those employed in the working up of pitchblende residues for radium. The cases of complete chemical identity between groups of radioactive elements, differing presumably in atomic weight, which now appear to include all the radioactive elements of period of average life longer than a year, are in direct conflict with the principle of the periodic law.

338. "Traube's molecular volume method applied to binary mixtures of organic substances." By William Ringrose Gelston Atkins.

The compounds and eutectic mixtures described by Philip (*Trans.*, 1903, **83**, 814) were prepared and their densities determined at or slightly above their melting or eutectic points respectively. Chloral hydrate was also studied.

In dealing with a compound, the molecular weight is given according to Traube by: $M = \rho(\Sigma$ atomic volumes + co-volume$)$, whereas if the calculation of the sum of the molecular weights of the molecules in the material being studied be made, one obtains: $M = \rho(\Sigma$ atomic volumes + n co-volumes$)$, where n is the number of molecules going to form the supposed compound. From the measure of agreement between the values thus obtained and the theoretical molecular weight of the assumed compound, it is possible to ascertain whether a compound exists or whether the fused mass is merely a mixture, eutectic or otherwise.

Below are given the calculated molecular weights obtained from the relation:

$$\mathrm{M} = \rho_t[\Sigma \text{ at. vol. } + \text{ co.-vol. at } 0^\circ\ (1 + \alpha t)]$$

for a compound, and

$$\mathrm{M} = \rho_t[\Sigma \text{ at. vol. } + n \text{ co.-vol. at } 0^\circ\ (1 + \alpha t)],$$

using the values for the constants given by Reychler (*Outlines of Physical Chemistry*, p. 68) and by Smiles (*Chemical Constitution and Some Physical Properties*, p. 143), where α is the coefficient of expansion of a gas.

	ρ.	M (as compd.).	M (as mixture).	M (theoretical).
(1) *o*-Nitrophenol and *p*-toluidine	$\rho_{16/15} = 1\cdot171$	221	251	246

Freezing-point curve shows eutectic point at 15·6°. Traube's method reveals, at the most, slight association.

(2) Phenol and α-naphthylamine	$\rho_{29/15} = 1\cdot125$	223	253	237

Both methods point to a considerably dissociated compound, m. p. 28·8°.

(3) Phenol and *p*-toluidine	$\rho_{30/15} = 1\cdot037$	186	214	201

Both methods show a considerably dissociated compound, m. p. 28·5° or 30·0°, according to which crystalline form was present.

(4) Phenol and diphenylamine	$\rho_{33/15} = 1\cdot075$	266	294	263

Freezing-point curve shows eutectic point at 18·1°. Traube's method points to the opposite conclusion.

(5) Phenol (2 mols.) and carbamide (1 mol.) .... $\rho_{61/15}=1{\cdot}104$ 216 264 244

Both methods point to a considerably dissociated compound, m. p. 61°.

(6) Aniline and *p*-cresol .... $\rho_{24/15}=1{\cdot}032$ 185 212 201

Both methods show a greatly dissociated compound.

(7) *p*-Toluidine and *a*-naphthol .... $\rho_{54/15}=1{\cdot}075$ 229 260 251

A highly dissociated compound is shown by the freezing-point curve. Traube's method agrees with this, but the results might almost equally well be taken as pointing to slight association among the like molecules.

(8) Chloral hydrate .... $\rho_{66/4}=1{\cdot}575$ 163·5 216·6 165·5

The magnetic rotation and chemical evidence point to a compound as does the above calculation.

(9) Ammonium thiocyanate (3 mols.) and thiocarbamide (1 mol.) .... $\rho_{105/15}=1{\cdot}231$ 298 423 304

Findlay's determinations of the freezing-point curves show that this is a mixture. Traube's method indicates a compound.

Thus in seven of the examples the evidence afforded by the various methods is not contradictory, whilst in two cases the results are absolutely at variance. It must, however, be remembered that the values obtained by Traube's method indicate association in the fused mass without distinguishing, for example, whether in No. 2 it is the phenol molecules which are associated with each other and the *a*-naphthylamine similarly, or whether the phenol and *a*-naphthylamine molecules combine in a certain percentage of cases. If, however, the latter be the case, it is not easy to see why the association of the phenol should be between one and two when mixed with *a*-naphthylamine, and between two and three when mixed with carbamide. For the latter conclusion cannot be avoided unless it is supposed that the association of the carbamide in phenol solution is sufficiently high to raise the average of the mixture (phenol, 66 per cent., carbamide, 33 per cent., by molecules) to the value found. This is rendered very unlikely, as a determination of the molecular weight of thiocarbamide in phenol (about 1·7 per cent. of thiocarbamide by weight) gave a nearly normal value, 87 instead of the theoretical 76. This result was obtained in an attempt to trace the freezing-point curve of phenol and thiocarbamide to see if a compound similar to the phenol–carbamide compound could be obtained. However, the separation of crystals of what had all the appearance of being thiocarbamide show an eutectic point at 36·8°, only 3·74° below the melting point of the pure phenol used. The thiocarbamide present at the eutectic point amounted to only 4·2 per cent.

Thus it seems fair to conclude that whilst by Traube's method alone it is not possible to decide whether the association is between the like molecules or the unlike, taking other facts into consideration the method may be considered trustworthy for temperatures up to 60° at any rate. Above this the effect of the coefficient a becomes considerable. In view, however, of the very good agreement in the case of chloral hydrate (163·5 calc., and 165·5 theoretical) at 66°, it seems to be quite allowable to use the method at 105° for the thiocarbamide–thiocyanate fused mass. The above evidence for the existence of Philip's compounds in the liquid state receives confirmation from Treitschke's viscosity measurements (*Zeitsch. physikal. Chem.*, 1907, **58**, 425). These show that the compounds exist as such, but in a largely dissociated condition. Rise of temperature increases the dissociation.

339. "Hydroxycodeine: a new alkaloid from opium."

By James Johnston Dobbie and Alexander Lauder.

This alkaloid was discovered by Messrs. T. and H. Smith, Edinburgh, in the mother liquors obtained in the working up of the opium alkaloids after the ordinary alkaloids have been eliminated. It has the formula $C_{18}H_{21}O_4N$, and is a tertiary base. It is soluble in water and the usual organic solvents. So far it has not been obtained in the crystalline condition. On heating, it softens about 40°, and is completely melted at 51°. It is slightly dextrorotatory, and contains one methoxyl group. The *hydrobromide*, $C_{18}H_{21}O_4N,HBr$, crystallises readily from water in large, hard, prismatic crystals. The *platinichloride* has the formula $(C_{18}H_{21}O_4N)_2,H_2PtCl_6$.

The alkaloid appears to be a hydroxy-derivative of codeine; its absorption spectra agree very closely with those of codeine, and the colour reactions of the two alkaloids are practically identical.

340. "Studies in the carbazole series."

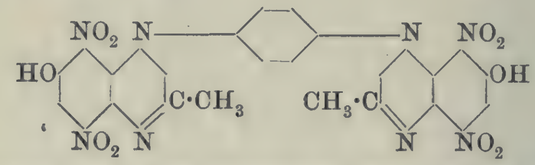
By Carl Gustav Schwalbe and Salomon Wolff.

The object of this work was to prepare mercaptans of carbazole with the view of converting them into sulphide dyes and sulphonic acids. It was found that in most cases, instead of the required mercaptan being obtained, the derivatives employed were reconverted into carbazole itself. In repeating the preparation of carbazoledisulphonic acid according to Schultz and Hauenstein's method (*J. pr. Chem.*, 1886, [ii], **33**, 1907), the authors obtained a disulphonic acid having different properties, giving, for example, a different disulphonyl chloride and disulphonamide. In sulphonating carbazole under various conditions, a monosulphonic acid was never obtained, but disulphonic acids or a mixture of di- and tri-sulphonic acids always resulted. Carbazole is easily sulphonated by 67 per cent. sulphuric acid, giving a disulphonic acid, differing from that of Schultz and Hauenstein, and also from the acid mentioned above. On sulphonating 3-nitrocarbazole and subsequent reduction, an amino-disulphonic acid was isolated.

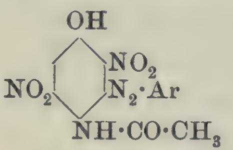
1-*Phenyl*-1 : 2 : 3-*benzotriazole*-5-*sulphonic acid* was prepared by the diazotisation of *o*-aminodiphenylamine-*p*-sulphonic acid. This triazole, on heating, gave carbazole instead of the expected monosulphonic acid.

341. "Syntheses with phenol derivatives containing a mobile nitro-group. Part III. Complex iminazoles, azo-compounds, and azides." By Raphael Meldola and Harold Kuntzen.

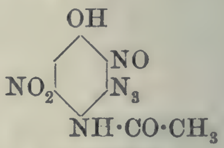
The authors indicated the existence of a new type of bisiminazoles, and described the first member of this series, which is a colloidal substance of the formula:



A further study of the interaction of trinitroacetylaminophenol and aromatic hydrazines has led to the discovery that asymmetric secondary hydrazines are without action, but that primary hydrazines yield azo-compounds of the type (I):



(I.)



(II.)

It was also shown that the trinitro-compound is readily decomposed by sodium azide with the formation of the triazo-compound (II).

342. "The correlation of viscosity with other constitutive properties." (Preliminary note.) By Thomas Percy Hilditch and Albert Ernest Dunstan.

The authors have been engaged for some time on an investigation concerning the effects of various constitutive features on the viscosity coefficient in an attempt to bring this property into line with molecular refraction, dispersion, magnetic rotatory power, optical rotatory power, and the like. They have found that in general a close parallelism exists between the effects of unsaturation (simple and conjugated) on these diverse properties.

In particular, the result of acetylenic union is invariably to raise the viscosity coefficient, whilst a similar observation was made in general for the ethylenic linking. On the other hand, the saturated compounds in all cases have the lower viscosity, and in most a noticeably greater molecular volume. Various cases of conjugated unsaturation also have been examined, and the authors have found a remarkable exaltation in comparison with the values obtained from unconjugated unsaturated substances.

Symmetrically conjugated compounds have been found to exhibit a still more extraordinary anomaly. As an illustration may be quoted the times of efflux for the following typical cases:

4-Hydroxy-3-methoxy-1-allylbenzene	2126·0	secs.
4-Hydroxy-3-methoxy-1-propenylbenzene ...	8160·0	,,
3 : 4-Methylenedioxy-1-allylbenzene	682·6	,,
3 : 4-Methylenedioxy-1-propenylbenzene......	1161·8	,,
Ethyl propyl ether	145·2	,,
Ethyl allyl ether......................................	140·7	,,
Ethyl propargyl ether...............................	206·2	,,

The authors propose to extend this line of work to such cases as ring formation, hydroaromatic and aromatic compounds, spatial propinquity of unsaturated groupings, symmetrical and unsymmetrical substitution in aromatic compounds, and viscosity constants for the various homologous series.

343. "Physical properties of mixtures of ether and sulphuric acid." By James Robert Pound.

Mixtures of ether and "100 per cent. sulphuric acid" were chiefly used in this investigation; some work was done with ethereal solutions of 95 per cent. sulphuric acid. All the experiments were carried out at 30°, and in a few cases also at 20°. In the case of none of the physical properties examined do the solutions obey the "normal mixture" rule. The specific volumes are up to 10 per cent. less than the theoretical values. The contraction on mixing is greatest about the equimolecular mixture. The conductivity of the mixtures with "the 100 per cent. acid" rises to a maximum for the 89 per cent. acid mixture. There is a sharp descent from this maximum to the minimum conductivity, which occurs with the 98 per cent. acid mixture. This minimum is similar to that obtained on adding a little water to 100 per cent. sulphuric acid. The viscosity curve for the ether–acid mixtures has a maximum at the 67 per cent. acid mixture, and closely resembles the corresponding curve for water–sulphuric acid solutions. Over the range from the 59 per cent. to the 89 per cent. acid mixture, the product of the viscosity and the conductivity varies linearly with the composition. The surface tensions, found by the method of drops, vary linearly with the composition over a large range—from the 20 per cent. to the 80 per cent. acid mixture. The vapour pressures of the solutions decrease as the percentage of acid increases, the fall of vapour pressure being greatest between the 40 per cent. and 50 per cent. acid mixture. Here, as in the previous cases mentioned, the curve resembles the corresponding one for water–sulphuric acid mixtures. The actual number or composition of the complexes that are certainly formed in the solutions cannot be given definitely.

344. "New syntheses of thioxanthone and its derivatives." (Preliminary note.) By Samuel Smiles.

In a previous communication (*Trans.*, 1910, **97**, 1290) it was shown that thioxanthone and its derivatives may be obtained by the condensation of aromatic substances with either *o*-carboxybenzenesulphinic acid or with *o*-thiolbenzoic acid. It has now been found that other four methods are available for the synthesis of these substances:

(1) Condensation of *o*-dithiobenzoic acid with aromatic derivatives in sulphuric acid.

(2) Condensation of *m*-hydroxy- or *m*-amino-benzoic acids with (*a*) suitable disulphides, or (*b*) certain sulphinic acids in sulphuric acid.

(3) Action of *o*-thiolbenzoic acid on certain quinones, and elimination of water from the product. The three last-named methods yield products the structures of which are known from those of the reagents. These reactions are being studied in detail.

345. "Cryoscopic, ebullioscopic, and association constants of trimethylcarbinol." By William Ringrose Gelston Atkins.

The cryoscopic constant of trimethylcarbinol was found to have the value $E=128$, from which, by van't Hoff's equation, the value for the heat of fusion, $s = 13{\cdot}84$ cal., is obtained. Taking de Forcrand's value, $s = 20{\cdot}98$ cal., E (calc.) $= 84{\cdot}5$. The appearance of the solid first in the form of minute needles, which soon change into orthorhombic plates, gives some ground for supposing that the experimental and calculated values of E differ because an unstable, crystalline modification is the first to separate out, in which $s = 13{\cdot}84$, whereas $s = 20{\cdot}98$ was determined from the stable form. This unstable form may be the modification which Tammann found to be stable only at high temperatures and pressures.

Boiling-point determinations give $E' = 17{\cdot}45$; calculation from the equations of van't Hoff, Tsakalotos, and Baume gives values ranging from $E' = 18{\cdot}97$ to $E' = 19{\cdot}78$, whilst dp/dT (calc.) $= 28{\cdot}4$.

Calculation from the observed values of γ_t by Ramsay and Shields' equation gives $x = 1{\cdot}388$ from 35° to 47°, and $x = 1{\cdot}304$ from 47° to 80°, whilst Walden's equation gives $x = 1{\cdot}094$ at the boiling point, 82·5°. Longuinescu's relation gives $x = 1{\cdot}12$ at 30°.

346. "The syntheses of 3-β-aminoethylindole and its formation from tryptophan." (Preliminary note.) By Arthur James Ewins and Patrick Playfair Laidlaw.

Since a number of bases derived from naturally occurring amino-acids have been recently shown to be physiologically active, it was thought desirable to prepare 3-β-aminoethylindole, the base corresponding with tryptophan (indole-3-α-aminopropionic acid). The base has been obtained in two ways.

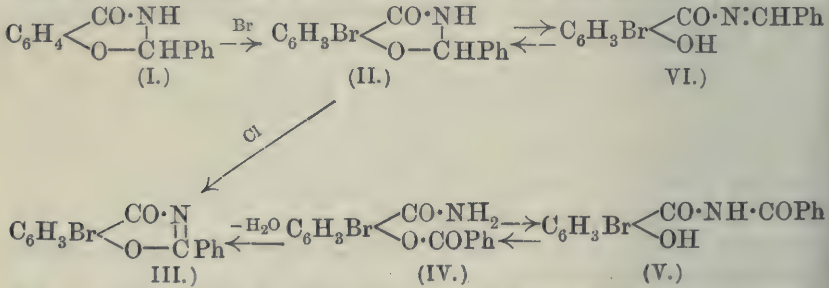
(1) By heating together γ-aminobutyrylacetal and phenylhydrazine in presence of zinc chloride. The reaction product, on suitable treatment, gives a good yield of the picrate of the desired base.

(2) By submitting tryptophan to the action of putrefactive organisms under conditions similar to those employed by Ackermann (*Zeitsch. physiol. Chem.*, 1910, **65**, 504) in the preparation of 4-β-aminoethylglyoxaline from histidine. A small quantity of a picrate identical in all respects with the synthetic compound was isolated. The base has been found to be physiologically active, producing a rise of blood pressure. The action has, however, yet to be fully worked out.

The details of the synthesis will, it is hoped, shortly be communicated, and experiments are in progress with a view to the production of other indole derivatives by the same process.

347. "6-Bromo-2-phenyldihydro-1 : 3-benzoxazine-4-one and related derivatives." By Ernest Chislett Hughes and Arthur Walsh Titherley.

2-Phenyldihydro-1 : 3-benzoxazine-4-one (I), on bromination in chloroform solution, yields the 6-*bromo*-derivative (II) (m. p. 223°), which, with chlorine in benzotrichloride solution at 110°, is dehydrogenated, and gives 6-*bromo-2-phenyl*-1 : 3-*benzoxazine*-4-*one* (III) (m. p. 208°). The latter is also obtained by dehydration of O-*benzoyl-5-bromosalicylamide* (IV) (m. p. 154°) under the catalytic influence of hydrogen chloride, and it suffers ring fission on hydrolysis in presence of alcoholic hydrochloric acid, producing N-*benzoyl*-5-*bromosalicylamide* (V) (m. p. 249°). *O*- and *N*-Benzoyl-5-bromosalicylamides show the same reciprocal transformations as the other previously-described *O*- and *N*-acylsalicylamides, and they have been obtained by similar methods. The dihydro-derivative (II) has been synthetically obtained from 5-bromosalicylamide and benzaldehyde, into which it decomposes on hydrolysis; whilst on treatment with alkali and pyridine, it rearranges to a very labile open-chain isomeride, syn-*benzylidene*-5-*bromosalicylamide* (VI).



348. "Reactivity of the halogens in organic compounds. Part V. Interaction of esters of the bromo-substituted fatty acids with silver nitrate in alcoholic solution." By George Senter.

The relative rates with which the bromine is eliminated from the esters of the lower bromo-substituted fatty acids by means of silver nitrate in alcoholic solution have been measured at 49·9°, and in some cases at 26·0°. The results for the higher temperature are summarised in the table, in which *k* represents the relative velocity-coefficients under comparable conditions :

Ester.	$k \times 10^4$.
Ethyl bromoacetate..................	0·208
,, α-bromopropionate	0·085
,, α-bromo*iso*butyrate...........	0·062
,, α-bromobutyrate...............	0·038
,, α-bromo*iso*valerate	0·022
Methyl bromopropionate	0·077
Ethyl ,, ,, ...	0·085
n-Propyl ,, ,, ...	0·087

Measurements have also been made with methyl alcohol as solvent, and also in mixtures of ethyl alcohol with other solvents. The results were compared with those obtained for the corresponding acids (*Trans.*, 1910, **97**, 246), and the effect of substitution on the reactivity of the bromine was discussed.

349. "Attempts to prepare glycerides of amino-acids."

By Roman Alpern and Charles Weizmann.

The following new compounds were described: *αα′-Dipropionin*, $C_9H_{16}O_5$, boiling at 170—173°/10 mm. *α-Bromoacetin*, $OH\cdot CH_2\cdot CH(OH)\cdot CH_2\cdot O\cdot CO\cdot CH_2Br$, a yellow oil boiling at 217—219°/10 mm. *αα′-Diacetoacetin*, $C_{11}H_{16}O_7$, prepared by condensing acetoacetic ester and glycerol in the presence of sulphuric acid, a heavy, yellow oil with an odour recalling that of ethyl acetoacetate; it boils at 157—160°/14 mm. *αβ-Dichloroacetoacetin*, $CH_3\cdot CO\cdot CH_2\cdot CO_2\cdot CH_2\cdot CHCl\cdot CH_2Cl$, a liquid boiling at 103—105°/14 mm. *Ethyl* N-*allylglycine*, $CH_2{:}CH\cdot CH_2\cdot NH\cdot CH_2\cdot CO_2Et$, prepared from allylamine and ethyl bromoacetate in ice-cold ethereal solution, a liquid boiling at 74—77°/15 mm.

ADDITIONS TO THE LIBRARY.

III. *Pamphlets.*

Autenrieth, *W.*, and **Koenigsberger**, *J.* Ueber ein neues Kolorimeter und dessen Verwendung zur Bestimmung von Blutfarbstoff, Eisen, Indikan und Kreatinin. (From the *Münch. med. Woch.*, 1910.)

Bruce, *W.* Report on cattle-feeding experiments. (*Bull. Edinburgh and East of Scotland Coll. Agric.*, No. 21, 1910.)

Buckingham, *Edgar.* On the definition of the ideal gas. (From the *Bull. Bur. Standards*, 1909, **6**.)

Clacher, *William.* The use of the refractometer in the analysis of jams and jellies, marmalades and confections. (From the *Int. Sugar J.*, 1910.)

Dittrich, *Max*, and **Leonhard**, *A.* Ueber Eisenoxydulbestimmungen in Silicaten. (From the *Ber. Vers. Oberrheinisch. Geol. Ver.*, 1910, **43**.)

Johannesburg. *Government Laboratories.* Report 1908–09. pp. 16. Pretoria 1910.

Luzzatto, *R.*, and **Satta**, *G.* Intorno al comportamento nell' organismo animale dei Jodoso-Jodil e Jodonio-composti. II. Comportamento del Jodil-benzolo. (From the *Arch. Farm. sperim. Sci.*, 1910, **9**.)

Menge, *George A.* A study of melting-point determinations. (*Bull. U.S. Hygienic Laboratory*, 1910, No. 70.)

Woburn Experimental Fruit Farm. Twelfth Report. By the **Duke of Bedford** and *Spencer U.* **Pickering.** pp. iv + 51. London 1910.

At the next Ordinary Scientific Meeting on **Thursday**, January **19th**, 1911, at **8.30** p.m., the following papers will be communicated:

"Intramolecular rearrangement of diphenylmethane *o*-sulphoxide." By T. P. Hilditch and S. Smiles.

"The reactions between chemical compounds and living muscle proteins." By V. H. Veley.

"The interaction of alloxan and glycine." By W. H. Hurtley and W. O. Wootton.

"The decomposition products of tetramethylammonium nitrite under the action of heat." By P. C. Rây and H. K. Sen.

"Retardation and acceleration in the dissolution of mercury in nitric acid in presence of minute quantities of ferric salts and manganese nitrate." By P. C. Rây.

"On *dl*- and *d*-Δ^2-*m*-menthenol(8) and *dl*- and *d*-$\Delta^{2:8(9)}$-*m*-menthadiene." By W. N. Haworth, W. H. Perkin and O. Wallach.

"The identity of xanthaline with papaveraldine." By Miss B. Dobson and W. H. Perkin.

"Amalgams containing silver and tin." By R. A. Joyner.

"Studies of the constitution of soap in solution: the electrical conductivity of sodium stearate solutions." By R. C. Bowden.

"Additive compounds of phenols and phenolic ethers with aromatic polynitro-derivatives." By J. J. Sudborough and S. H. Beard.

ERRATUM.

PROCEEDINGS, 1910.

Page	Line	
268	6	*for* "seven carbon ethers" *read* "seven-carbon ether (ethyl amyl ether)."

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The Ordinary Scientific Meetings for 1910-11 will be held on the following Thursdays at 8.30 p.m. :—

October 20th, 1910
November 3rd, ,,
,, 17th,* ,,
December 1st, ,,
,, 15th,* ,,
January 19th,* 1911
February 2nd, ,,
,, 16th,* ,,

March 2nd, 1911
,, 16th,* ,,
April 6th,* ,,
May 4th, ,,
,, 18th,* ,,
June 1st, ,,
,, 15th,* ,,

*Council Meetings will be held on these days.

Annual General Meeting, Thursday, March 23rd, 1911, at 5 p.m.

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THE Chemical Society was founded on February 23rd, 1841, and its irst General Meeting was held on March 30th of that year. In 1848, Charter of Incorporation was granted to the Society by the Crown, nder the conditions of which it consists of Fellows, Honorary and oreign Members, and Associates.* The Fellows elect out of their wn body a Council consisting of a President, Vice-Presidents, a reasurer, two Secretaries, a Foreign Secretary, and twelve other ellows, by whom the business of the Society is conducted.

The object of the Society, as laid down in the Charter, is the eneral advancement of Chemical Science, by the discussion and pubication of new discoveries, and the interchange of valuable informaion respecting them.

A Candidate for election as a Fellow of the Chemical Society ust send to the Secretaries a Certificate subscribed by not less than ve Fellows of the Society, to three at least of whom he must be peronally known.† The Certificate will be read at three Ordinary Meetngs of the Society, and the Candidate will afterwards be balloted for. Vhen elected, he will receive notice thereof from the Secretaries.

Each Fellow has the right to be present and to vote at all Meetngs of the Society, and to propose Candidates for admission into the ociety, and is entitled to one copy of the Annual Publications so ong as his Annual Subscription be not in arrear. He is also ntitled to the use of the books in the Society's Library, under such estrictions as the Council may deem necessary. He has the rivilege of introducing to Ordinary Scientific Meetings of the Society, wo visitors, whose names are entered in a book kept for that purpose, ogether with the name of the Fellow introducing such visitors.

When elected, every Candidate previous to admission is required, ithin three months from the date of his election, to pay an admission e of £4, and either his first annual subscription, or his life composiion fee; otherwise his election becomes void. The annual subscription be paid by Fellows is £2. The subscriptions of Fellows become due n the first day of January of every year. The life composition fee is 30, excepting that Fellows who have paid ten annual subscriptions pay life composition fee £20; Fellows who have paid fifteen annual sub-

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[*] No elections of Associates have taken place for many years.

[†] In the case of Candidates resident abroad unable to obtain this number of gnatures, the Council have power to accept a certificate signed from personal nowledge by one Fellow of the Society, and to recommend its presentation for ballot.

scriptions pay £15; Fellows who have paid twenty annual subscriptions pay £12; and Fellows who have paid twenty-five annua subscriptions pay £10.

If a Candidate be elected during the month of November o December, he will not be called upon to pay any annual subscription fo the current year, and will not be entitled to receive the publication of the Society for that year.

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All communications for the Journal and for the Proceedings of th Society should be addressed to "The Secretaries, Chemical Society Burlington House, W."

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In all cases, an abstract of the paper, not exceeding three hundre words in length, should be supplied for insertion in the Proceedings.

Communications are put down on the list for reading in the order i which they are received.

Communications which have already appeared in any foreig journal will not be published in the Society's Transactions, unles this course is specially recommended by the Publication Committe and this recommendation approved by the Council.

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† Post free to Fellows.

The *Journal*, which is published on the last day of each month, ncludes the Transactions of the Chemical Society and Abstracts of chemical papers published in other Journals.

The *Proceedings* contain certain papers read at the meetings and abstracts of the remainder and of the discussions. They are, as a rule, issued to the Fellows about a week after each Ordinary Scientific Meeting.

The Annual Reports on the Progress of Chemistry contain an epitome of the principal definite steps in advance which have been made during the year. Cases for binding the Annual Reports can be obtained from the Assistant Secretary, price One Shilling each.

RESEARCH FUND.

The Research Fund of the Chemical Society has been established for the purpose of assisting investigators by defraying the cost of expensive materials. The income accruing from the munificent donations received from the Goldsmiths' Company and from the Perkin Memorial Fund will be devoted as far as possible to the encouragement of research in (*a*) metallurgical and inorganic chemistry and (*b*) the chemistry of coal-tar products, respectively.

The Committee meets twice a year to consider applications for grants; and forms of application, which can be obtained from the Assistant Secretary, must be lodged with the Secretaries by the end of May and November in each year.

NAMES OF HONORARY AND FOREIGN MEMBERS.

NUMBER NOT TO EXCEED FORTY.

e of Election.	
n. 20, 1898	Arrhenius, Prof. Dr. Svant August, F.R.S., Bergsgaten 18, Stockholm
y 18, 1876	Baeyer, Geh. Rath Prof. Dr. Adolph von, F.R.S., Arcis-str. 1, Munich
b. 2, 1888	Boisbaudran, Lecoq de, Rue de Longchamp 113, Passy, Paris
y 18, 1904	Clarke, Prof. Frank Wigglesworth, LL.D. (Aberd.), United States Geological Survey, Washington, D.C., U.S.A.
y 18, 1904	Curie, Madame Marie, La Sorbonne, Paris
n. 20, 1898	Curtius, Geh. Rath Prof. Dr. Theodor, Universität, Heidelberg
ne 16, 1892	†Fischer, Geh. Rath Prof. Dr. Emil, F.R.S., Hessischestrasse 1, Berlin, N., Germany
b. 1, 1883	Fittig, Prof. Dr. Rudolph, Universität, Strassburg
n. 20, 1898	Franchimont, Prof. Dr. Antoine Paul Nicolas, Rapenburg 104, Leyden
b. 6, 1908	Gautier, Prof. Armand Emile Justin, 9, Place-des-Vosges, Paris
ne 16, 1892	Graebe, Prof. Dr. Carl, Westendstrasse 28, Frankfurt-am-Main, Germany
b. 6, 1908	Haller, Prof. Albin, 10, Rue-Vauquelin, Paris
b. 6, 1908	Hittorf, Dr. Johann Wilhelm, Westfälische Wilhelms-Universität, Münster, Westfalen, Prussia
b. 2, 1888	Hoff, Geh. Rath Prof. Jacobus Henricus van't, LL.D. (Cantab. and Chicago), Hon. D.Sc. (Manc. and Heidelberg), Hon. Dr. Ing. (Brunswick and Delft.), Hon. M.D. (Greifswald and Utrecht), F.R.S., Filandastrasse 9, Steglitz, Berlin, Germany
n. 20, 1898	Körner, Prof. Wilhelm, R. Scuola Superiore d'Agricoltura, Milan
b. 2, 1888	Ladenburg, Geh. Reg.-Rath Prof. Dr. Albert, Kaiser Wilhelmstrasse 108, Breslau
b. 6, 1908	Le Bel, Joseph Achille, 250, Rue Saint Jacques, Paris
b. 6, 1908	Le Chatelier, Prof. Henri Louis, 73, Rue Notre Dame des Champs, Paris
ne 16, 1892	Lieben, Prof. Dr. Adolph, Mölkerbastei 5, Vienna I., Austria
y 18, 1904	Liebermann, Geh. Rath Prof. Dr. Carl, Matthäikirchstrasse 29, Berlin, W., Germany
rch 4, 1909	Lunge, Georg, Prof., Ph.D. (Breslau), Hon. Dr. Ing. (Karlsruhe), Rämisstrasse 56, Zürich, Switzerland
y 18, 1904	Morley, Prof. Edward Williams, Hon. D.Sc. (Yale), West Hartford, Conn., U.S.A.

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† Faraday Lecturer, 1907.

Date of Election.	
Jan. 20, 1898	*Ostwald, Geh. Rath Prof. Dr. Wilhelm, LL.D. (Aberd.), Grossbothe Kgr., Sachsen
Jan. 20, 1898	Remsen, Prof. Ira, Johns Hopkins University, Baltimore, U.S.A.
Feb. 6, 1908	Richards, Prof. Theodore William, S.B. and Hon. LL.D. (Have ford), A.M. and Ph.D. (Harvard), Hon. Sc.D. (Yale), Hon. Ph. (Prague), Harvard University, Cambridge, Mass., U.S.A.
June 16, 1892	Schiff, Prof. Dr. Hugo, Via Gino Capponi 3, Florence, Italy
June 16, 1892	Schlœsing, Prof. Dr. Théophile, Institut Agronomique, Paris
Jan. 20, 1898	Spring, Prof. Walthère, Rue Beckmann 32, Liége, Belgium
Jan. 20, 1898	Troost, Prof. Louis Joseph, Rue Bonaparte 84, Paris
Jan. 20, 1898	Waals, Prof. Dr. Johannes Diderik van der, T.C., Hooftstraat 11 Amsterdam
Feb. 6, 1908	Wallach, Prof. Dr. Otto, Königl. Georg August Universität, Göttinge Prussia.

* Faraday Lecturer, 1904.

FARADAY LECTURERS.

1869. Jean Baptiste André Dumas.
1872. Stanislao Cannizzaro.
1875. August Wilhelm von Hofmann.
1879. Charles Adolphe Wurtz.
1881. Hermann Ludwig Ferdinand von Helmholtz.
1889. Dmitri Ivanovitsch Mendeléeff.
1895. Lord Rayleigh.
1904. Wilhelm Ostwald.
1907. Emil Fischer.

LONGSTAFF MEDALLISTS.

1881. Thomas Edward Thorpe.
1884. Cornelius O'Sullivan.
1888. William Henry Perkin.
1891. Francis Robert Japp.
1894. Horace Tabberer Brown.
1897. William Ramsay.
1900. William Henry Perkin, jun.
1903. William Jackson Pope.
1906. Walter Noel Hartley.
1909. Frederic Stanley Kipping.

order that the List of Fellows may be as complete as possible, those Fellows ose names and degrees do not appear in full are requested to communicate th the Assistant Secretary. Inaccuracies and changes of Address should be orted without delay.

NAMES OF FELLOWS.

‖ Denotes Life Members.
Trans. Denotes Members who have contributed Papers published in the Society's Transactions.
Proc. " " " " " " " " Proceedings.
C. " " " served on Council of the Society; P. as President; V.P. as Vice-President; T. as Treasurer; S. as Secretary; F.S. as Foreign Secretary.

e of ction.			
93	Trans.		Abell, Robert Duncombe, D.Sc. (Wales), Ph.D. (Leipzig), F.I.C., University College of South Wales and Monmouthshire, Cardiff
71	Trans.	C. 1882-4	Abney, Sir William de Wiveleslie, K.C.B., Hon. D.C.L. (Dun.), Hon. D.Sc. (Vict.), Sc.D. (Dub.), F.R.S., F.I.C., Rathmore Lodge, Bolton-gardens-south, S.W.
83			Abraham, Alfred Clay, F.I.C., 87, Bold-street, Liverpool
90			‖Abrines, Gustavus Anthony, Sanitary Commissioner's Office, Gibraltar
75	Trans.		Acworth, Joseph John, Ph.D. (Erlangen), F.I.C., Thornbank, Shootup-hill, Brondesbury, N.W.
05			Adam, Adam Lawson Kelly, 296, Bath-street, Glasgow
92			Adams, Arthur, F.I.C., Kelvin House, Edgbaston-road, Smethwick
77	Trans.		‖Adams, Matthew Algernon, F.R.C.S. (Eng.), F.I.C., The Kulm, Bearsted, near Maidstone
10			Adams, Percival Frederick, 81, Rock-avenue, Gillingham, Kent
92			Adcock, Samuel Robert, The St. Helens Smelting Co., Atlas-court, St. Helens
96			Addie, Robert, Suffolk House, Laurence Pountney Hill, E.C.
81	Trans.		Adeney, Walter Ernest, Hon. D.Sc. (R.U.I.), A.R.C.S.I., F.I.C., Burnham, Queen's-park, Monkstown, Co. Dublin
85	Trans.		Adie, Richard Haliburton, M.A. (Cantab.), B.Sc. (Lond.), 136, Huntingdon-road, Cambridge
09			Adlam, George Henry Joseph, B.A. and B.Sc. (Oxon.), The Grammar School, Leeds
85			Adriance, John Sabine, Ph.D., Williams College, Williamstown, Mass, U.S.A.
06			Agar, Shelton Gottlieb, La Fontaine, Clifton, Guernsey, Channel Islands

Date of Election.			
1909			Aiyer, Yegna Narayan, M.A. (Madras), 2, Pike's-walk, Cambridge
1908			Akers, Noel Charles, A.I.C., 26, King's-avenue, Muswell Hill, N.
1879			Albright, George Stacey, M.A. (Cantab.), Bromesberrow-place, Ledbury
1893			Albuquerque, John Pedrozo d', Prof., M.A. (Cantab.), F.I.C., Government Laboratory, Barbados, West Indies
1892			Alcock, John While, Central Brewery, 45, Mott-street, Birmingham
1902			Alder, John Frederick, 28, Claverly-grove, Church-end, Finchley, N.
1903			Alderton, Gilbert John, B.Sc. (Lond.), F.I.C., 46, Westmount-road, Eltham Park, Kent
1886			Allan, James Henry, L.R.C.P. and L.R.C.S. (Edin.), 45, Walton-vale, Liverpool
1896			Allan, John, 77, Northern-grove, West Didsbury, near Manchester
1907			Allan, John Campbell, 91, Norse-road, Scotstoun, Glasgow
1907			Allen, Alfred Frederick, B.Sc. (Lond.) 35, Purrett-road, Plumstead, S.E.
1894			Allen, Frederick John, Phœnix Chemical Works, Upper North-street, Poplar, E.
1901			Allen, Frederick Thomas, B.Sc. (Dun.), The Grammar School, Ramsey, Huntingdon
1870			Allen, John, Phœnix Chemical Works, Upper North-street, Poplar, E.
1904			Allen, William Harold Richard, c/o Straits Trading Co., Butterworth, Penang, Straits Settlements
1894			Allibon, George Henry, Mayfield, Lisburn-road, Balmoral, Belfast
1905			Allison, James Albert, Luchana Laboratory, Apartado 45, Bilbao, Spain
1908	Trans.		Allmand, Arthur John, M.Sc. (L'pool), Muspratt Laboratory, The University, Liverpool
1899			Allworthy, James Herbert, 41, Comyn-road, Wandsworth Common, S.W.
1899			‖Allworthy, Samuel William, M.A., M.D., B.Ch., L.M. and D.P.H. (Dub.), The Manor House, Antrim-road, Belfast
1903			Alton, William Lester St. John, F.I.C., 11, Briar-walk, Putney, S.W.
1885	Proc.		‖Amphlett, Edward Greenhill, M.A. (Oxon.), 3, Union-place, Worthing
1890			Anderson, Frederic Alfred, B.Sc. (Lond.), F.I.C., 24, Grainger-street-west, Newcastle-on-Tyne
1895			Anderson, Herbert, The Blue School, Wells
1899			Anderson, James William, Howard House, Northfleet, Gravesend

Date of Election.			
1906			Anderson, Robert, Chester-road-west, Sunderland
1901	Trans.		Anderson, William Carrick, M.A., D.Sc. (Glas.), 7, Scott-street, Garnethill, Glasgow
1892			Anderson, William Smellie, Christmas Island, Straits Settlements
1908			Andreae, Edward Philip, Ph.D. (Berlin), c/o The British Glanzstoff Manufacturing Co., Ltd., Flint
1905	Trans.		Andrews, Albert Edward, St. Hilda, 20, Carew-road, Thornton Heath, Surrey
1888			Andrews, Edward Arthur, St. Mary's Hospital, Paddington, W.
1882			‖Andrews, Launcelot Winchester, Ph.D. (Göttingen), 823 Bracly-street, Davenport, Iowa, U.S.A.
1905	Trans.		Angel, Andrea, M.A. and B.Sc. (Oxon.), 17, Banbury-road, Oxford
1877			Angell, John, F.I.C., 6, Beacon's-field, Derby-road, Withington, Manchester
1909			Anklesaria, Jehangir Dhanjishaw, Hotel Lincoln Hall, 6-11, Upper Bedford-Place, W.C.
1898	Trans.		Annable, Henry William Coupe-, Gresham House, Egham, Surrey
1909			Annett, Harold Edward, B.Sc. (Lond.), Agricultural Research Institute, Pusa, Bengal, India
1905			Anthony, Charles, jun., M.Inst. C.E., Casilla de Correo, 149, Bahia Blanca, Argentine, S. America
1879			‖Appleby, Herbert, 2, John Dalton-street, Manchester
1903			Appleyard, George Henry, F.I.C., 4, Ash-grove, Beverley-road, Hull
1890	Trans.		Appleyard, James Robert, Royal Technical Institute, Salford
1903			‖Appleyard, Percy, Albany, Western Australia
1884			Archbutt, Leonard, F.I.C., The Yews, Madeley-street, Derby
1875			Armistead, William, M.B. and C.M. (Edin.), Stapleford, Cambridge
1900	Proc.		Armitage, Francis Paul, 13, Palliser-road, West Kensington, W.
1903	Trans.		‖Armstrong, Edward Frankland, D.Sc. (Lond.), Ph.D. (Berlin), c/o Messrs. Huntley & Palmers, Reading
1899			Armstrong, Frederick William, Hawksdale Lodge, Dalston, Cumberland
1870	Trans.	C.1873-5 S. 1875-93 P.1893-5	‖Armstrong, Henry Edward, Prof., LL.D. (St. Andrews), Ph.D. (Lips.), F.R.S., 55, Granville-park, Lewisham, S.E.; and Central Technical College, Exhibition-road, S.W.
1909			Armstrong, James A. H., c/o Mr. J. Flynn, Thornton's-avenue, Sea View, Natal, S. Africa.
1905			Arnaud, Francis William Frederick, F.I.C., Chemical Laboratory, 16, Arundel-street, Portsmouth
1909			Arnfield, Harold, Peak Lodge, Buxton-road, Stockport

Date of Election.			
1906	Trans.		Arup, Paul Seidelin, M.A. (Nova Scotia), 62, Haverstock Hill, N.W.
1903			Ashdown, Herbert Henry, 88, Southgrove-road, Sheffield
1900			Ashton, James, Hacken Sewage Works, Moses-gate, Bolton
1905			Ashwell, James Henry, 117, Waterloo-crescent, Nottingham
1901			Aspinall, Thomas, 62, Gilnow-road, Bolton
1900	Trans.		Aston, Bernard Cracroft, F.I.C., 71, Devon-street, Wellington, New Zealand
1901	Trans.		Aston, William George, 12, Douglas-road, Goodmayes, Ilford, E.
1903			Atkinson, Harford Montgomery, B.Sc. (Wales), Ph.D. (Göttingen), 69, George-street, Limerick, Ireland
1903			Atkinson, Edwin Boyles, Furze Glen, Lambert-road, Grimsby
1872	Trans.		‖Atkinson, Robert William, B.Sc. (Lond.), F.I.C., 44, Stuart-street, Cardiff
1862	Trans.	C. 1874-8	‖Attfield, John, Prof., M.A. and Ph.D. (Tübingen), F.R.S., F.I.C., Ashlands, Watford
1903	Trans.		Attwell, Herbert Moore, A.R.C.S., St. Margaret's-hill, Bradford-on-Avon
1872	Trans.		‖Attwood, George, M.Inst.C.E., Steyning Manor, Stogursey, Somerset; and Mansion House Chambers, 13, Sise-lane, Queen Victoria-street, E.C.
1908			Aubertin, Thomas, B.A. (Oxon.), Maybank, Carnoustie, N.B.
1903			Aubrey, Henry James, The Cross, Worcester
1895	Trans.		‖Auden, Harold Allden, 13, Broughton-drive, Grassendale, Liverpool
1886			‖Audley, James Aloysius, B.Sc. (Lond.), A.R.C.S., F.I.C., 17, Gladstone-place, Hanley
1906	Trans.		‖Austin, Percy Corlett, M.A. (Cantab.), University College, Reading
1892			Avery, David, Working Men's College, Melbourne, Australia
1896			Aykroyd, Henry Edward, Oakwood Dye Works, Thornton-road, Bradford
1891			Aylan, John Charles, 200, Eglinton-road, Shooter's-hill, Woolwich, S.E.
1908			Ba, Maung, B.A. (Calcutta), Rangoon College, Rangoon, Burma
1903			‖Badcock, William Cornish, M.A. (Cantab.), The Grammar School, Crediton, Devon
1907	Trans.		Bagley, George, c/o Young's Chemical Works, 41B, Kent-terrace, Wellington, New Zealand
1904			Baguley, Allan, B.Sc. (Wales), F.I.C., Harris Institute, Preston
1907			Bailey, Francis James, Findon Hill, Sacriston, Durham
1875	Trans.		‖Bailey, George Herbert, Ph.D. (Heidelberg), D.Sc. (Lond.), The University, Manchester; and Kinlochleven, Argyll, N.B.
1893			Bailey, Henry, 14, Selborne-road, Ilford

ate of lection.			
900	Trans.		Bain, Alexander William, B.A. and B.Sc. (Lond.), F.I.C., Fairlight, Muswell-rise, Muswell Hill, N.
884			‖Bain, Daniel, United Alkali Co., Ltd., Allhusen's Works, Gateshead-on-Tyne
891			Bairstow, John, Burley, Queen's-park, Chester
901			Baker, Arthur, 2, Carlton-avenue, Horn's Cross, Greenhithe, S.O., Kent
889			‖Baker, Charles Frederic, B.Sc. (Lond.), Ph.D. (Strassburg), Technical College, and 29, Roker-park-road, Sunderland
883	Trans.		‖Baker, Charles John, The Schools, Shrewsbury
899			Baker, Clement Harrison, c/o Messrs. C. Harrold & Co., 2 and 3, St. Paul's-square, Birmingham
907	Trans.		Baker, Frank, B.Sc. (Lond.), A.I.C., c/o Nobel's Explosives Co., Ltd., Stevenston, Ayrshire
902			Baker, Frederick Guy Stirling, M.A. (Oxon.), A.I.C., Marryatt's Lodge, Snaresbrook, Essex
900			Baker, Frederick Nolan, Lieut., R.A., c/o Messrs. W. T. Allen & Co., 132, Queen Victoria-street, E.C.
881	Trans.		Baker, Harry, F.I.C., Epworth House, Moughland-lane, Runcorn
884	Trans.	C. 1899-03	‖Baker, Herbert Brereton, M.A. and D.Sc. (Oxon.), F.R.S., Christ Church, Oxford
893	Trans.	C. 1908-	Baker, Julian Levett, F.I.C., Stainesbury Holt, Kingston-road, Staines
1908	Proc.		Baker, Thomas James, D.Sc. (Lond.), B.Sc. (Birm.), Trebarwith, Chester-road, Erdington, Birmingham
1901			Baker, Thomas Thorne, 15, Grosvenor-gardens, Cricklewood, N.W.
1908			Baker, William Henry Benson, B.A. (Oxon.), Frognal Dene, Hampstead, N.W.
1873			Baldock, John Henry, Overdale, St. Leonard's-road, Croydon
1901	Trans.		Ball, Walter Craven, M.A. (Oxon.), Warren Cottage, Hayes, Kent, and Guy's Hospital, S.E.
1907			Ball, William Robert, B.Sc. (Lond.), 48, Cambridge-road, Thornaby-on-Tees
1892			‖Ballantyne, Horatio, F.I.C., 75, Chancery-lane, W.C.
1908			Ballantyne, William Henry, B.Sc. (Glas.), 99, Holmdene-avenue, Herne Hill, S.E.
1896			Ballingall, William, M.A. (St. Andrews), Ardarrock, Dundee
1891	Trans.	C. 1905-08	Baly, Edward Charles Cyril, Prof., F.R.S., F.I.C., The University, Liverpool
1886			Bamber, Henry Kelway George, Ingress House, Greenhithe, Kent
1890	Proc.		Bamber, Montague Kelway, F.I.C., The Laboratory, Hyde-park-corner, Colombo, Ceylon
1896			Banerjee, Gopal Chandra, Kaiser Soap Co., Cawnpore, India
1910			Banister, Fred., B.Sc. (Wales), The Grammar School, Doncaster

Date of Election.		
1907		Banks, Arthur John, Holm-lane, Woodchurch-road, Birkenhead
1904	Trans.	Barbour, William, M.A. and B.Sc. (St. Andrews), F.I.C., Dalswinton, 26, All Saints'-road, Peterborough
1905		Barbrook, George Henry, c/o Messrs. T. Prentice & Co., Stowmarket, Suffolk
1880		‖Barclay, Arthur Edward, 95, Farringdon-street, E.C.
1903	Trans.	‖Barger, George, M.A. (Cantab.), D.Sc. (Lond.), The Goldsmiths' College, New Cross, S.E.
1906		Barker, Arthur Ernest, B.A. and B.Sc. (Lond.), Royal Grammar School, Colchester
1909		Barker, Donald William Elsom, 2, Hope-street, Wrexham
1890		‖Barker, Joseph, Rev., M.A. and D.D. (Oxon.), Newton House, Newton, near Nottingham
1903	Trans.	Barker, Thomas Vipond, M.A. and B.Sc. (Oxon.), Mineralogical Dept., University Museum, Oxford
1896		Barker, William Henry, B.Sc. (Lond.), Addiscombe, Empress-avenue, Wanstead Park, Essex
1894		Barlet, Stéphane, B. ès Sc. (Gall.), 97, St. Mark's-road, North Kensington, W.
1897		Barlow, Herbert William Leyland, M.A. and M.D. (Oxon.), M.R.C.S. and L.R.C.P. (Lond.), D.P.H., (Cantab.), Holly Bank, Croftsbank-road, Urmston, Manchester
1897	Trans.	Barlow, William, F.R.S., The Red House, Stanmore, Middlesex
1891		Barnes, Edward Arthur, 194, Hammersmith-road, W.
1905		Barnes, James Hector, Prof., B.Sc. (Birm.), F.I.C., Government College of Agriculture, Lyallpur, Punjab, India
1875		‖Barnes, Richard Leburn, Phœnix Chemical Works, Hackney Wick, N.E.
1907	Trans.	Barnett, Edward de Barry, B.Sc. (Lond.), 9, Collingham-road, South Kensington, S.W.
1909	Trans.	Baron, Harold, B.Sc. (Vict.), 21, Underhill-road, East Dulwich S.E.
1908		Barr, Guy, B.A. (Cantab.), B.Sc. (Lond.), Pyrmont, Clarence-road, Teddington, Middlesex
1888		‖Barraclough, William Herbert, F.I.C., Mortomley, near Sheffield
1891		Barratt, John Treeby, Bronheulog, Mostyn, North Wales
1869		Barret, Edward Louis, B.Sc. (Lond.), F.I.C., 12, Avenue de la Grande Armée, Paris
1906	Trans.	Barrett, Ernest, B.Sc. (Lond.), 121, Algernon-road, Lewisham, S.E.
1908		Barrett, Maurice, Cliff Lawn, Hyde-park, Leeds
1901		Barrie, Thomas Stewart, 4, Newton-street, Charing-cross, Glasgow

e of tion.			
5	Trans.		Barrowcliff, Marmaduke, F.I.C., 82, Highfield-road, Dartford, Kent
2			‖Barton, Robert, Royal Mint, Melbourne, Australia
8			Barton, Robert, jun., 1, Fairfield-avenue, Fairfield, Droylsden, Manchester
8			Baskerville, Charles, B.Sc. (Virginia), Ph.D. (N. Carolina), College of the City of New York, New York City, U.S.A.
4	Trans.	C. 1870-3, 90-3	‖Bassett, Henry, F.I.C., 26, Belitha-villas, Barnsbury, N.
7	Trans.		Bassett, Henry, jun., D.Sc. (Lond.), Ph.D. (Munich), D. ès Sc. (Nancy), F.I.C., The University, Liverpool
1			Bate, William, Upton Villa, Hayle, Cornwall
3			Bateman, John, Clovelly, 14, Stirling-road, Clapham Rise, S.W.
6			Bathurst, Charles, B.A. (Oxon.), 3, Stone-buildings, Lincoln's Inn, W.C.
0			Batley, Ward Allen, M.Sc. (Manc.), 197, Eccles New-road, Salford, Manchester
0			Baume, Georges, 44, Quai des Eaux, Vivès, Geneva, Switzerland
5			Baxter, John George, River View, Burch-road, Rosherville
6			Bay, Lauritz Hansen, B.Sc. (Lond.), The Grammar School, Wirksworth, Derbyshire
2			Bayliss, Charles, Mino, Castle Bromwich, near Birmingham
6			Bayliss, William Heath, Brewery House, Ashwell, Herts.
4			‖Bayne, James, 31, Vaughan-terrace, Harrow
9			‖Bayne, William Thirlwall, LL.D. (Cantab.), Brockhill, Broadclyst, Exeter
7			Beadle, Alec Alfred, Wenden, Dawlish
1	Trans.		Beadle, Clayton, Oak Bank, Lansdown-road, Sidcup, S.O., Kent
1			‖Beadnell, Charles Edward, Major, R.A., Hafod, Llandinam, S.O., Mont.
3			Beadnell, Charles Marsh, M.R.C.S. (Eng.), L.R.C.P. (Lond.), Fleet Surgeon, Hafod, Llandinam, Mont.
7			Beale, William Phipson, K.C., M.P., 10, New-court, Carey-street, Lincoln's Inn, W.C.; and 2, Whitehall-court, S.W.
3			Beam, William, M.A. and M.D. (Penn.), F.I.C., Chemical Laboratory, Gordon College, Khartoum, Soudan
9			Bean, Percy, 17, Dickinson-street, Manchester
2			Beanes, Alfred Edward, Falcon Works, Wallis-road, Hackney Wick, N.E.
4			‖Beanes, Edward, Moatlands, Paddock Wood, Kent
0			Beardmore, George Russell, L.R.C.P. (Lond.), M.R.C.S. (Eng.), L.S.A., D.P.H. (Cantab.), Warwick House, Upper-street, Islington, N.

Date of Election.			
1901			Beaven, Edwin Sloper, Eastway, Warminster
1890	Trans.		Beck, Charles Ridgeway, F.I.C., 53, Norroy-road, Putney, S.W
1874	Trans.		||Beckett, George Henry, F.I.C., 35, South Beach-road, Ardrossa N.B.
1906			Beckett, Richard Henry, Prof., B.Sc. (Lond.), The Victor College of Science, Nagpur, C.P., India
1901			Bedford, Frederick, B.Sc.(Lond.), Ph.D. (Halle), 9, Market-plac Sleaford, Lincs.
1879	Trans.	C. 1895-9	Bedson, Peter Phillips, Prof., M.A. (Dun.), D.Sc. (Lond. ar Dun.), B.Sc. (Vict.), F.I.C., Armstrong College of Scienc Newcastle-on-Tyne
1901			Bedwell, John Cardew, B.Sc. (Lond.), 65, High-street, Colchest
1905			Bees, William James, B.Sc. (Lond.), 43, Ash-grove, Hyde-par Leeds
1899			Beesley, Frederick Arnold, B.Sc. (Lond.), 7, Whitmore-roa Beckenham, Kent
1910			Behrens, Herbert Arthur, Sidney Sussex College, Cambridge
1872	Trans.	C. 1907-	||Beilby, George Thomas, Hon. LL.D. (Glas.), F.R.S., F.I.C., 1 University-gardens, Glasgow
1891			Belbin, Tom St. John, Capt., Nortonthorpe Hall, near Huddersfie
1891			||Bell, Albert Edward, F.I.C., 59, Trinity-square, Southwar S.E.
1886	Trans.		Bell, Chichester Alexander, B.A. and M.B. (Dub.), F.I.C Torbrex, Headington-hill, Oxford
1889			Bell, Edward Wightman, The Chantry, Spalding
1898			Bell, Hugh Poynter, M.A. (Cantab.), 17, Tothill-street, Wes minster, S.W.
1865	Trans.		||Bell, J. Carter, A.R.S.M., F.I.C., The Cliff, Higher Broughto Manchester
1907			Bell, John Forbes, Craigmillar, Edinburgh
1889			||Bell, Percy Carter, F.I.C., Milburn, New Jersey, U.S.A.
1906			Bell, William Edward, Langholm, Yarborough-road, Lincoln
1904	Trans.		Bellars, Albert Ernest, B.A. (Cantab.), Magdalene Colle Cambridge
1905			Belton, Francis George, B.A. (Dun.), 336, Belgrave-road, B mingham
1879			Bemrose, Joseph, F.I.C., 56, St. Famille-street, Montreal, Cana
1874			||Bendix, David, F.I.C., Sutherland Lodge, 371, Romford-roa Forest Gate, E.
1902	Proc.		Bengough, Guy Dunstan, M.A. (Cantab.), The University, a 25, Huskisson-street, Liverpool
1902			Benham, Keith Benham, B.Sc. (Lond.), F.I.C., Dean's Hi Stafford

Date of Election.		
1881		‖Benjamin, Marcus, A.M. (Lafayette), Ph.B. (Columbia), Ph.D. (Nashville), Sc.D. (Pittsburg), LL.D. (Annapolis), U.S. National Museum, Washington, D.C., U.S.A.
1900	Trans.	Bennett, Alexander Hutcheon, c/o Messrs. G. H. Ogston & Moore, Catania, Sicily
1904		Bennett, Charles Thomas, B.Sc. (Lond.), F.I.C., 102, Queen's-road, Wimbledon, S.W.
1903		Bennett, Colin Noël, Escot, Penzance, Cornwall
1909	Trans.	Bennett, Hugh Garner, M.Sc. (Leeds), 5, St. Nicholas-road, Beverley
1905		Bennett, Joseph, Windsor Printing Co., North Adams, Mass., U.S.A.
1892	Trans.	Bensusan, Arthur John, The Ouro Preto Gold Mines of Brazil, Ltd., Minas de Passagem, Ouro Preto, Brazil
1904		Bentley, Walter Henry, M.A. (Oxon.), Merton, Everton-road, Addiscombe, Croydon
1896	Trans.	Bentley, William Henry, B.Sc. (Vict.), 12, Cromwell-terrace, Irlam, near Manchester
1907		Benton, Frank Stanley, Hursthead, Reigate, Surrey
1890		Bentz, Ernest, 107, Shaw-lane, Dinting, near Manchester
1902	Trans.	Bergtheil, Cyril, Research Station, Sirseah, Mozufferpore Post Office, T. S. Railway, India
1882		‖Beringer, John Jacob, A.R.S.M., F.I.C., Basset-road, Camborne, Cornwall
1895	Trans.	Berkeley, The Rt. Hon. Randal Thomas Mowbray, The Earl of, F.R.S., Foxcombe, Boar's Hill, Oxford
1890		‖Berncastle, Richard, 15, Ladbroke-gardens, Notting Hill Gate, W.
1893		Berridge, Douglas Jesse Penfold, M.A. (Oxon.), The Laboratory, Malvern College
1906	Trans.	‖Berry, Arthur John, B.A. (Cantab.), 5, University-gardens, Glasgow
1882		‖Berry, Edward Elhanan, 44, London Wall, E.C., and Vice-Consulate, Bordighera, Italy
1898		Berry, Reginald Arthur, Prof., F.I.C., The West of Scotland Agricultural College, 6, Blythswood-square, Glasgow
1891		Berry, Thomas William, Education Office, Pentre, Rhondda, Glam.
1888	Proc.	Berry, William, 7, Hampton-park, Redland, Bristol
1909	Trans.	Best, Stanley Robert, M.Sc. (Manc.), Woodlea, Wellington-road, Whalley Range, Manchester
906		Bethea, Oscar Walter, Prof., M.D. (Miss.), Ph.G. (Atlanta), Mississippi Medical College, Meridian, Miss., U.S.A.
910		Bethwaite, John, 48, Northumberland-street, Workington; and c/o Morriston Spelter Works, Morriston, Glam.

Date of Election			
1883	Trans.	C. 1898-1900	‖Bevan, Edward John, F.I.C., 3, New-court, Carey-street, W.C.
1908			Bevan, Edward Morris, 105, High-street, Kenfig-hill, Bridgend
1886			Bevan, John Williams, F.I.C., Risedale, St. James-crescent, Swansea
1903			Beveridge, Wilfred William Ogilvy, Major, R.A.M.C., D.S.O., M.B. (Edin.), D.P.H. (Cantab.), R. Army Clothing Dept., Grosvenor-road, S.W.
1897			Bhaduri, Jyoti Bhushan, M.A. (Calcutta), Krishnaghur College, Krishnaghur, Dist. Nadia, Bengal, India
1903			Bhaduri, Kula Bhushan, Prof., M.A. (Calcutta), Canning College, Lucknow, India
1908			Bhunsri, Prince Mom Chow, Director of Agriculture for County of Puket, Puket, Siam
1903			Bibby, Charles Drake, Heath-row, Strafford-road, Twickenham
1903			Bibby, Robert Gordon, 5, Halfmoon-street, W.
1865			‖Bickerdike, William Edward, F.I.C., Bryers Croft, Wilpshire, near Blackburn
1908			Bickerstaffe, Robert, Chilterns, Wooburn-green, Bucks.
1901			‖Bickford, Harding, 46, Currie-street, Adelaide, South Australia
1875			Biggart, John William, F.I.C., Chemical Laboratory, 29, Cathcart-street, Greenock
1881			Bingley, John, Northampton
1900			Binks, Frederick Nisbet, 29, Beech-grove, Whitley Bay, Northumberland
1908			Birch, William Colet, B.A. (Cantab), A.I.C., 22, Glazbury-road, West Kensington, W.
1894			Bird, William Rowland, Chem. Lab., G.W.R. Works, Swindon
1898			Birkett, Walter, 23, Carline-road, Lincoln
1906			Birt, Roderick Harold Capper, Rev., B.A. (Oxon.), St. Peter's College, Radley, Abingdon
1879			‖Black, Andrew Heggie, St. John's, Wakefield; and Moor Lodge, Harrogate
1904			Black, John Wyclif, 20, Mardale-crescent, Edinburgh
1909			Blackburn, Albert Riley, B.Sc. (Lond.), A.R.C.S., Marshville, Derby-road, Widnes
1886			Blackburn, Thomas, 580, Coventry-road, Birmingham
1899	Trans.		Blackman, Walter Lionel, Stanthorpe-road, Streatham, S.W.
1903			Blackshaw, George Neville, B.Sc. (Wales), Analytical Laboratory, Dept. of Agriculture, Salisbury, Rhodesia, S. Africa
1899			Blackshaw, John Frank, The Midland Dairy Institute, Kingsto Fields, Derby
1902			Blair, Herbert, 23, Ashley-road, West Harton, South Shields
[illegible]01			Blake, George Stanford, 15, Vernon-street, Broughton, Mancheste

Date of Election		
1890	Trans.	Blake, Robert Frederick, F.I.C., Chemical Department, Queen's College, Belfast
1890		Blake, William Henry, 12, Lombard-street, Newcastle-on-Tyne
1875		‖Blanshard, Charles Thomas, M.A. (Oxon.), Bebington, Birkenhead
1906		Blatchley, Charles Frederick Polwhele, B.A. (Oxon.), 13, Templars-avenue, Golders Green, N.W.
1892		Bleckly, Arthur Sanderson, Marldon, Thelwall, Warrington
1902		Blenkinsop, Richard, c/o Messrs. May & Baker, Ltd., Garden Wharf, Church-road, Battersea, S.W.
1890		Blenkinsop, William Edmund Brandford, c/o Messrs. May and Baker, Ltd., Garden Wharf, Church-road, Battersea, S.W.
1909		Bletcher, Henry Ernest John, Prof., College of Pharmacy, Winnipeg, Manitoba, Canada
1903		Bliss, Henry James Wheeler, M.A. (Oxon.), 50, City-road, E.C.
1899		Blofeld, Stuart, Rev., B.A. and B.Sc. (Lond.), Saltley Training College, Birmingham.
1896		‖Blood, Maurice, M.A. (Oxon.), 16, Alexandra-road, Kingston-on-Thames
1891		Bloomer, Frederick John, F.I.C., Penpont, Clydach, S.O. Glamorgan
1890	Trans.	Blount, Bertram, F.I.C., 76 and 78, York-street, Westminster, S.W.
1888		Bloxam, Arthur George, F.I.C., 105, Birkbeck Bank-chambers, Southampton-buildings, W.C.
1883	Trans.	‖Bloxam, William Popplewell, B.Sc. (Lond.), F.I.C., 15, Crescent-mansions, Elgin-crescent, Holland Park, W.
1903		Bluman, Nicholas John, 3, Rue de l'Est, Neuilly-sur-Seine, Paris
1887		Blundstone, Edwin Richardson, B.A. (Cantab.), Heathfield, Hampton Hill, Middlesex
1865	Trans.	Blunt, Thomas Porter, M.A. (Oxon.), F.I.C., Tower-place, Shrewsbury
1896		Blyde, Joseph Edwin Alger, Merlin House, Broomgrove-road, Sheffield
1875	Trans.	Blyth, Alexander Wynter, M.R.C.S. (Eng.), L.S.A. (Lond.), F.I.C., 26, Avenue-road, Regent's Park, N.W.
1892		Blyth, Meredith Wynter, B.A. (Cantab.), B.Sc. (Lond), F.I.C., The Lodge, Ardsley, Barnsley
1908	Trans.	Blyther, Donald Francis, B.Sc. (Lond.), A.R.C.S., 77, Knights-road, Silvertown, E.
1875		‖Boake, Arthur, Chemical Works, Stratford, E.; and High-standing, Loughton, Essex
1902		Boardman, Ernest, B.Sc. (Vict.), 619, St. Helens-road, Bolton

Date of Election.			
1878			Bodmer, Richard, F.I.C., Analytical Laboratory, 16, Southwark street, S.E.
1898			Bogert, Marston Taylor, Prof., B.A. and Ph.B. (Columbia), Hon. LL.D. (Clark), Columbia University, New York City, U.S.A.
1906			Bogue, Thomas Going Stoney, 5, Kenilworth-square, Dublin
1869	Trans.		‖Bolas, Thomas, F.I.C., 60, Grove-park-terrace, Chiswick, W.
1901			Bolton, Edward Richards, 16, Flanchford-road, Ravenscourt Park, W.
1899			‖Bond, Alfred Ernest, 13, Hermitage-road, Edgbaston, Birmingham
1883			Bond, Henry Charles, Rev. M.A. (Oxon.), Belle Vue Hall Brighton
1893	Trans.	C. 1909-	‖Bone, William Arthur, D.Sc. (Vict.), Ph.D. (Heidelberg), F.R.S., West House, 18, Lidgett-park-road, Roundhay, Leeds
1893			Boone, William Thomas, B.Sc. (Lond.), 6, Sydenham-villas Cheltenham
1884			Borland, William Dalrymple, F.I.C., Beacon Lodge, Green Street Green, near Dartford, Kent
1881			‖Borns, Henry, Ph.D. (Greifswald), 5, Sutton Court-road, Chiswick W.
1895			‖Borradaile, Lancelot Alexander, M.A. (Cantab.), Selwyn College, Cambridge
1861			‖Bosanquet, Robert Holford Macdowall, M.A. (Oxon.), F.R.S., Castillo Zamora, Realijo Alto, Teneriffe, Canary Islands
1894	Proc.		Bose, Chuni Lal, Prof., 25, Mohendra Bose's-lane, Calcutta
1881			Bostock, George Henry, 151, Medland-street, West Toronto, Canada
1881	Trans.		Bothamley, Charles Herbert, M.Sc. (Leeds), F.I.C., Tangle Wood, Southside, Weston-super-Mare
1887	Trans.		Bott, William Norman, Ph.D. (Heidelberg), 16, St. Helens-place, E.C.
1909			Bottomley, Hubert Frederick, The Cedars, Wavertree-road, South Woodford, N.E.
1869			‖Bottomley, James Thomson, B.A. (Dub.), M.A. and D.Sc. (R.U.I.), Hon. LL.D. (Glas.), F.R.S., 13, University-gardens, Glasgow
1886			Bottomley, William Beecroft, Prof., M.A. (Cantab.), Ph.D., 35, Downside-crescent, Hampstead, N.W.
1894			Boul, William Good, M.A. and LL.D. (Dub.), D.C.L. (Dun.), Tideswell Grammar School, near Buxton
1910			Bourdillon, Robert Benedict, Buddington, Midhurst
1905	Trans.		Bousfield, William Robert, M.A. (Cantab.), K.C., St. Swithin's, Hendon
1891			Bovell, John Redman, Dodd's Botanical and Experimenta Station, Barbados, West Indies

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365		‖Bowdler, Arthur Clegg, F.I.C., 20, Bank-terrace, Wellington-street, Blackburn
388		Bower, Frank, c/o Messrs. Truman, Hanbury and Buxton, Spitalfields, E.
394		Bowes, Harry, F.I.C., Messrs. Bowes and Sims, 40, Radford-street, Blackley, Manchester
906		Bowis, William John, Ph.D. (Zürich), 97, North-road, West Bridgford, Notts.
399		Bowles, Bertram Hennessey, Overdale, Eastwood-road, South Woodford, N.E.
396		Bowley, Joseph John, Wellington Works, Battersea Bridge, S.W.
362		Bowman, Frederic Hungerford, F.I.C., Assoc. Inst. C.E. and M.E., 4, Albert-square, Manchester
396		‖Bowman, Herbert Lister, M.A. (Oxon.), Greenham-common, Newbury, Berks.
394	Trans.	Boyd, David Runciman, Prof., D.Sc. (Glas.), Ph.D. (Heidelberg), F.I.C., The Hartley University College, Southampton
01		Boyers, Henry, 20, Knox's-street, Sligo
69		‖Braby, Frederic, Bushey Lodge, Teddington
10		Bracewell, Geoffrey Alfred, 20, Heaton-grove, Bradford
03		Bradbury, Samuel, Ferncliff, Milton-grove, Glebelands-road, Ashton-on-Mersey, Cheshire
95		Bradford, Henry, Pampas Cottage, Goodwood, Chichester
76		‖Bradley, Nathaniel, Sunnyside, College-road, Whalley Range, Manchester
88		Bradshaw, Charles, 169, Spring Vale-road, Sheffield
10		Brady, Oscar Lisle, B.A. (Cape of Good Hope), 51, Upper Bedford-place, W.C.
06		Braid, Arthur Forbes, c/o The New Jersey Steel Co., Rahway, N.J., U.S.A.
908		Brakes, William Sudderick, 119, Steade-road, Sheffield
94	Trans.	Brame, John Samuel Strafford, Royal Naval College, Greenwich, S.E.
03		Branch, George Thomas, P.O. Box 51, Umtali, Rhodesia, S. Africa
82		Branson, Frederick Woodward, F.I.C., 14, Commercial-street, Leeds; and Wynneholme, Far Headingley, Leeds
08		Braun, Marie Joseph Arsène, Ph.D. (Bâle), 5, Aspinall-road, Brockley, S.E.
82	Trans.	Brauner, Bohuslav, Prof., Ph.D. (Prague), Hon. D.Sc. (Manc.), New Chemical Laboratory, Bohemian University, Prague, VI., Bohemia
96		Bray, Daniel, 63, Morehampton-road, Donnybrook, Dublin

Date of Election.			
1909			Breakspear, Henry Shaw, B.A. (Oxon.), The Grammar Scho Ludlow
1905			||Brettell-Vaughan, Edward Shipley Hewitt Edwards, Cv Cottage, The Cwm, Aston-on-Clun, Salop.
1883			Briant, Lawrence, 24, Holborn-viaduct, E.C.
1901			Bridges, Joseph Samuel, B.Sc. (Lond.), 45, Thistlethwaite-ro Clapton, N.E.
1904	Trans.		Bridgett, Robert Currie, M.A. and B.Sc. (St. Andrew Dunlossit, Dryburgh-avenue, Rutherglen, Glasgow
1897			Brierley, James, 33 and 35, French-street, Southampton
1890	Trans.		Brierley, John Thomas, Highfield, Golden Hill, Leyland, n Preston
1898			Brierley, Joseph, B.Sc. (Vict.), Ashton-road, Failswort Manchester
1893	Trans.		Briggs, John Frederick, Auchmuty Paper Mills, Markinc Fife, N.B.
1906			Briggs, Richard Victor, Research Station, Sirseah, Mozufferp P.O., T.S. Railway, Bengal, India
1905	Trans.		Briggs, Samuel Henry Clifford, B.Sc. (Vict.), Greenbank, Cle heaton, Yorks.
1883			||Briggs, Thomas Lynton, F.I.C., 188, Central-avenue, Flushi L.I., U.S.A.
1884			||Briggs, William, LL.D., D.C.L., M.A., B.Sc., Burlingt House, Cambridge
1902			Brincker, John Augustus Herman, B.A., M.B., B.C. and D.P. (Cantab.), B.A. (Cape of Good Hope), M.R.C.S. (Eng.), L.R.C. (Lond.), F.I.C., 8, Christ Church-road, Hampstead, N.W.
1889			Broadbent, Harry, F.I.C., 183, Hyde Park-road, Leeds
1879			||Broadbent, John James, F.I.C., Waikino, Auckland, New Zeala
1883			Brock, John, J.P., F.I.C., Gwern-Tyno, Colwyn Bay, N. Wal
1893			||Brockbank, John Edwin, The Croft, Kirksanton, viâ Carnforth
1898			Brooke, Arthur, M.A. (Cantab.), The Grammar School, Caist Lincs.
1900			Brooke, Charles Berjen, Colne House, Brantham, near Mannin tree, Essex
1900			Brooke, John Richard, J.P., F.I.C., Government Opium Facto Singapore, Straits Settlements
1906			Broome, James Spears, M.Sc. (Manc.), 18, Seedley-park-roa Pendleton, Manchester
1886	Trans.		||Brothers, Horace Edward, B.Sc. (Lond.), F.I.C., Clooney-pa Londonderry
1876	Trans.	C. 1910-	Brown, Adrian John, Prof., M.Sc. (Birm.), F.I.C., West Hea House, Northfield, Worcs.

Date of Election.			
1867	Trans.	C. 1872-4, V.P. 81-4, 90-1. P. 91-3	Brown, Alexander Crum, Prof., M.A., M.D., and F.R.C.P. (Edin.), D.Sc. (Lond.), LL.D. (Aberd. and Glas.), F.R.S., F.I.C., 8, Belgrave-crescent, Edinburgh
1870			Brown, David, F.I.C., 93, Abbey-hill, Edinburgh
1891			Brown, Edward Hilton, c/o Messrs. W. Ropes and Co., St. Petersburg, Russia
1873	Trans.	C. 1881-3	‖Brown, Frederic Douglas, Prof., B.Sc. (Lond.), University College, Auckland, New Zealand
1884			Brown, Frederic William, Ingleside, 39, Loveday-road, West Ealing, W.
1892			Brown, George Fitz-, A.R.S.M., F.I.C., The Broughton Copper Co., Ditton Copper Works, Widnes
1897			Brown, Gerald Noël, 20, Cullum-street, E.C.
1880			Brown, Henry, F.I.C., Benskin's Brewery, Watford, Herts.
1871	Trans.	C. 1883-7, V.P. 94-7, 1904-7 T. 1903-04 F.S. 1907-	†Brown, Horace Tabberer, LL.D. (Edin.), F.R.S., F.I.C., 52, Nevern-square, Kensington, S.W.
1908			Brown, James, 20, Tower-road, Dartford, Kent
1905			Brown, John Coggin, B.Sc. (Dun.), Geological Survey of India, Calcutta, India
1882			Brown, Joseph, Ashleigh House, Savile Town, Dewsbury
1892			Brown, Reginald Busby, c/o The Badische Co., Ltd., 2, Samuel Ogden-street, Manchester
1908			Brown, Walter, jun., County Offices, Hamilton, N.B.
1884			Brown, William George, Prof., Ph.D. (N. Carolina), B.S. (Virginia), University of Missouri, Columbia, Missouri, U.S.A.
1896			Browne, Charles Edward, B.Sc. (Lond.), Christ's Hospital, West Horsham, Sussex
1893			Browne, Frank, F.I.C., Government Civil Hospital, Hong Kong, China
1873			Brownen, George, Grove-road-east, Avon-park, Christchurch
1899	Trans.		Browning, Kendall Colin, Prof., M.A. (Cantab.), Medical College, Colombo, Ceylon
1890			Brownsword, Frank, M.Sc. (Vict.), F.I.C., Bryn Derwen, Old Colwyn, N. Wales
1902			Bruce, Alexander, B.Sc., The Laboratory, Hyde-park-corner, Colombo, Ceylon
1894	Trans.		Bruce, James, B.Sc. (Lond.), Ph.D. (Munich), A.R.C.S., F.I.C., The Technical College, Huddersfield
1901			‖Bruce-Kingsmill, Julian, Major, R.A., M.A. and B.Sc. (Glas.), 196, Deansgate, Manchester

† Longstaff Medallist, 1894.

Date of Election.		
1903		Brühl, Paul, Civil Engineering College, Sibpur, near Calcutta, India
1898	Trans.	‖Brünnich, Johannes Christian, F.I.C., Department of Agriculture, Brisbane, Queensland
1909		Brunskill, Hubert, 71, West End-road, Southall
1893	Trans.	‖Brunton, John Dixon, c/o Prof. O. W. Richardson, Princeton, N.J., U.S.A.
1902		Bryant, Vernon Seymour, B.A. (Cantab.), Trelawne, Crowthorne, Berks.
1877	Trans.	‖Buch, Carl von, M.A. (Oxon.), F.I.C., 66, Paddington-street, W.
1877	Trans.	Buchanan, John Young, M.A. (Cantab.), F.R.S., F.I.C., 26, Norfolk-street, Park-lane, W.
1910		Buchner, Eduard, Ph.D. (Munich), Burgstrasse 8, Breslau I, Germany
1876		‖Buckmaster, Charles Alexander, M.A. (Oxon.), 16, Heathfield-road, Mill Hill Park, Acton, W.
1902		Bucknell, Edwin Thomas Holman, Kingsholme School, Weston-super-mare
1907	Trans.	Buckney, Frank, B.A. (Cantab.), Custom House, Madras, India
1903		Buggé, Erasmus Robert, 13, Prince's-avenue, Church End, Finchley, N.
1901		Bult, Herbert John, 18, Billiter-street, E.C.
1890		Bunting, Henry Herbert, Oficina de Ensayes F. C. C. del Peru, Callao, Peru
1896		Burbridge, James Kerry, F.I.C., The Orchard, Philip-lane, Tottenham, N.
1891		Burford, Samuel Francis, Beechworth, Stoneygate-road, Leicester
1910		Burger, O. K. H., Prof., Ph.D. (Munich), Civil Engineering College, Sibpur, Calcutta, India
1894	Trans.	Burgess, Herbert Edward, Fairfield, Rolleston-road, Burton-on-Trent
1901		Burgess, Perciyal James, M.A. (Cantab.), 8, Gunnersbury-avenue, Ealing Common, W.
1884		Burgess, William Thomas, F.I.C., 20, Priory-road, Bedford Park, W.
1903		Burghard, William Godsell, 43, New Oxford-street, W.C.
1884		‖Burland, Jeffrey Hale, Colonel, c/o Fraser Library, Montreal, Canada
1897		Burland, Richard Oxley, J.P., Poolstock House, Wigan
1901		‖Burnett, Theodore Ridley, B.Sc. (Vict.), Ph.D. (Bâle), The Grammar School, Kirkby Lonsdale, Westmoreland

ate of lection.		
893		Burnham, John Charles, B.Sc. (Vict.), F.I.C., Cordite Factory, Wellington, Nilgiri Hills, India
882	Trans.	Burrell, Benjamin Arthur, F.I.C., 8, Springfield Mount, Leeds
902	Trans.	Burrows, Harry, Ph.D. (Heidelberg), A.R.C.S., F.I.C., The Green, Southgate, N.
901	Trans.	Burrows, Merrick William, M.Sc. (Vict.), Dunkirk, Devizes
905	Trans.	Burt, Bryce Chudleigh, B.Sc. (Lond.), Department of Agriculture, Cawnpore, India
909	Trans.	Burt, Frank Playfair, B.Sc. (Lond.), Elmhyrst, Weston-super-mare
891		Burton, William, Clifton Junction, near Manchester
901		Burton, William, B.A. (Cantab.), B.Sc. (Wales), 110, Mayfield-road, Sanderstead, Croydon
903		Bury, Ernest, M.Sc. (Vict.), Brackley Coke Works, Little Hulton, near Bolton, Lancs.
909		Bury, Frank Ward, B.Sc. (Manc.), 14, Osbourne-street, Hebden Bridge
894		Bush, William, School of Science and Art, Free Library, Newport, Mon.
910		Buswell, Henry Leslie Farmer, B.A. (Cantab.), 169, Queen's-gate, S.W.
1890		Butcher, William James, B.Sc. (Lond.), Queen Elizabeth Grammar School, Ashbourne, Derbyshire
1895		Butler, David Butler, 41, Old Queen-street, Westminster, S.W.
1890		Butler, William Waters, Southfield, Norfolk-road, Edgbaston, Birmingham
1894		Buttemer, Robert William, St. Mary's, Godalming, Surrey
1875		Butterfield, John Cope, F.I.C., 79, Endlesham-road, Balham, S.W.
1892		Butterfield, William John Atkinson, M.A. (Oxon.), F.I.C., 66, Victoria-street, S.W.
1902		Buxy, Tarit Kanti, Prof., Govt. College, Jubbulpore, C.P., India
1888		Byrn, George Alexander, F.I.C., 97, Pitt-street, Sydney, N.S.W.
1906		Byrom, Thomas Henry, F.I.C., The Laboratory, Wigan Coal and Iron Co., Ltd., Wigan
1903		Bywaters, Hubert William, D.Sc. (Lond.), Ph.D. (Würzburg), A.R.C.S., F.I.C., 11, Kingly-street, W.
1903		Cadman, William Henry, B.Sc. (Wales), Ministry of Education, Cairo, Egypt
1893		‖Cahill, Robert Saunderson, Sunnyside, Heckmondwike
1894	Trans.	‖Cain, John Cannell, D.Sc. (Vict. and Tübingen), 28, Pembury-road, Clapton, N.E.
1906		Calam, Harold, M.Sc. (Leeds), B.Sc. (Manc.), F.I.C., 71, Cemetery-road, Beeston-hill, Leeds

Date of Election.		
1904		Caldecott, Lawrence, 56, Stanley-street, Fairfield, Liverpool
1898	Proc.	Caldecott, William Arthur, B.A. (Cape of Good Hope), Bo 67, Johannesburg, S. Africa
1891		‖Calder, William Alexander Skeen, Ormidale, Little Moor hill, Smethwick, near Birmingham
1907	Trans.	Caldwell, Kenneth Somerville, B.Sc. (Wales), Ph.D. (Leipzig) F.I.C., Bankipore, India
1904	Trans.	Caldwell, Robert John, D.Sc. (Lond.), Coventry House, Wilton avenue, Southampton
1906	Trans.	Caldwell, William, M.A. (R.U.I.), Physiological Department Trinity College, Dublin
1884		Caley, Edward James, Chapel Field Works, Norwich
1907		Callan, Thomas, M.Sc. (Manc.), Ph.D. (Heidelberg), 6, Victoria street, Dunstable
1909		Callister, William Edward, B.Sc. (Manc.), 2, Victoria-avenue Onchan, Douglas
1903	Trans.	Calvert, Harry Thornton, Ph.D. (Leipzig), M.Sc. (Leeds), B.Sc (Vict.), F.I.C., West Riding of Yorkshire Rivers Board Wakefield, Yorks.
1900		Calvert, Sidney, A.M. (Harvard), B.Sc. (McGill Univ.), Stat University, Columbia, Miss., U.S.A.
1907	Trans.	Cameron, Alexander Thomas, M.A. and B.Sc. (Edin.), Physiological Department, University of Manitoba, Winnipeg, Canad
1875		Cameron, John Macdonald, F.I.C., Castle Hill, Tain, N.B.
1892		Campbell, Andrew, The Palms, Dunneedaw, Rangoon, Burma
1905		Campbell, Eric William, 10, Cambridge-gardens, Richmond Hill Surrey
1903		Campbell, Thomas, 38, Eastbourne-street, Liverpool
1909		Campbell, Walter, c/o Messrs. J. A. Devenish & Co., Ltd., The Brewery, Weymouth
1898		Campion, Alfred, F.I.C., 144, Wellington-street, Glasgow
1896		Candy, Hugh Charles Herbert, B.A. and B.Sc. (Lond.), F.I.C., The College, London Hospital, E.
1898		Cannon, Matthew James, 16 and 17, Devonshire-square, Bishopsgate-street, E.C.
1900		Cantin, Angélo, Prof., Royal College of Mauritius, Vacoas, Mauritius
1910		Canton, Howard, 2, Gloucester-road, Regent's Park, N.W.
1910		Cardoso, Ettore, D. és Sc. (Grenoble), 3, Grande-rue, Geneva, Switzerland
1888		Carey, Alfred Edward, M.Inst.C.E., 36, Victoria-street, S.W.
1892	Trans.	Carey, Arthur, B.Sc. (Vict.), 1, Grassendale-road, Grassendale, near Liverpool

te of ection.		
09		Carey, William Gordon, A.I.C., St. John's Institute, 2, High-street, Homerton, N.E.
06		Carmichael, John, Government Laboratory, Clements Inn-passage, Strand, W.C.
02		Carmichael, Thomas Burnell, 18, Eastdale-road, Wavertree, Liverpool
89		Carmody, Patrick, Prof., F.I.C., Department of Agriculture, Port of Spain, Trinidad
99	Trans.	‖Carpenter, Henry Cort Harold, Prof., M.A. (Oxon.), Ph.D. (Leipzig), The University, Manchester; and 11, Oak-road, Withington, Manchester
08		Carpenter, John Arthur, B.A, (Oxon.), 23, Richmond-road, Exeter
06		Carpenter, Percy Henry, A.I.C., c/o Indian Tea Association, Heeleaka Experimental Station, Korea-Kuthia P.O., Assam, India
99		Carpmael, Wilfred, 24, Southampton-buildings, Chancery-lane, W.C.
95	Trans.	‖Carr, Francis Howard, F.I.C., Kelvin, Church-avenue, Sidcup, S.O., Kent
87		Carrington, George Carrington, Missenden Abbey, Great Missenden, Bucks.
902		Carrodus, Fred, Glen Fern Tower, Lansdowne-road, Wimbledon, S.W.
882		‖Carruthers, Robert, Kirkbank House, Dumfries
893		Carswell, Thomas Retson, 13, Penge-road, South Norwood, S.E.
901	Trans.	Carter, William, Sewage Works, Bury
867		‖Carulla, Facundo Joaquin Ramon, Argyll-terrace, 84, Rose-hill-street, Derby
895		Case, Thomas Bennett, B.A. (Oxon.), Brewers' Laboratory, Messrs. Guinness, Son & Co., Dublin
879		‖Cassal, Charles Edward, Col., V.D., F.I.C., Town Hall, Kensington, W.
907	Trans.	Caton, Frederic William, B.A. (Oxon.), B.Sc. (Lond.), Taunton School, Taunton
903		‖Caudwell, Ben, B.A. (Lond.), 28, Wigfull-road, Sheffield
909		Caulkin, Howard Alfred, B.Sc. (Lond.), A.I.C., 26, Dairy House-road, Derby
898	Trans.	Caven, Robert Martin, D.Sc. (Lond.), F.I.C., University College, Nottingham
902		Challen, Matthew Bradbury, School of Mines, Daylesford, Victoria, Australia
874		Chaloner, George, Combe House, Colyton, Axminster
880		Chamberlain, Arthur Garratt, 3, Market-place, Rugby

Date of Election.			
1906			Chamberlain, Percy Garratt, M.A. (Cantab.), 3, Market-place Rugby
1909			Chambliss, Hardee, Prof., M.S. (Vanderbilt), Ph.D. (John Hopkins), Department of Chemistry, Oklahoma Agricultura and Mechanical College, Stillwater, Oklahoma, U.S.A.
1883			‖Chambres, Gordon Crewe, Rev., Grammar School, Wigan
1883			‖Chance, Alexander Macomb, J.P., c/o Messrs. Chance and Hunt Ltd., Chemical and Cement Works, Oldbury, Birmingham
1902			‖Chance, Kenneth Macomb, M.A. (Cantab.), 14, Cornwall-terrace Regent's Park, N.W.
1909			Chand, Lakshami, M.A. (Allahabad), B.Sc. (Vict.), c/o Messrs. Ram Chand Bulakidas, Naudau Sahn's-street, Benares City India
1872			‖Chandler, Charles F., Prof., Ph.D., Columbia University, Wes 116th-street, New York City, U.S.A.
1889			‖Chaplin, Edward Mitchell, Ph.D. (Würzburg), F.I.C., Publi Analyst's Office, Wakefield
1886	Trans.	C. 1908-10	Chapman, Alfred Chaston, F.I.C., 8, Duke-street, Aldgate, E.C.
1895			Chapman, Arthur Jenner, F.I.C., Baronsmere, Stanhope-avenue, Church-end, Finchley, N.
1898	Trans.		Chapman, David Leonard, B.A. (Oxon.), Jesus College, Oxford
1899	Trans.		Chapman, Edgar Marsh, F.I.C., Cairnsmore, Manor-road, Scarborough
1891			Charles, Rhys Pendrill, F.I.C., Bacteriological Laboratory, King' College, Strand, W.C.
1900			Chater, Arthur Brand, 65, Queen-street, Brisbane, Queensland
1894	Trans.	C. 1900-03	Chattaway, Frederick Daniel, M.A. (Oxon.), D.Sc. (Lond.), Ph.D. (Munich), Hon. B.Sc. (Birm.), F.R.S., F.I.C., 103, Woodstock-road, Oxford
1895			Cheadle, Walter William, M.A. (Oxon.), Woodlands, Bridge-road, Grays
1899			Cheater, Thomas John, B.Sc. (Lond.), 3, The Mansions, Star an Garter, Putney, S.W.
1900			Cheeseright, John Henry, B.Sc. (Lond.), 7, Claremont-place, Gateshead-on-Tyne
1910			Cheetham, Thomas Patrick, Government School, Vrijheid, Natal, S. Africa
1908			Chew, John Henry, 46, Lytham-road, Blackpool
1897	Trans.		Chikashigé, Masumi, D.Sc. (Kyoto), College of Science and Engineering, Imperial University, Kyoto, Japan
1910			Child, Arthur James, University College, Gower-street, W.C.
1897			Cholerton, Alfred Foster, c/o Messrs. A. de St. Dalmas & Co., 40½, Belgrave-gate, Leicester

Date of Election.			
1891	Trans.		‖Chorley, John Christmas, Bewsey, Oxford-road, Birkdale, Lancs.
1907			‖Christie, John, B.A. (Cantab.), Eton College, Windsor
1874			Christopher, George, Walkden Works, Verney-road, Bermondsey, S.E.
1882			Chrystal, William James, F.I.C., 7, West George-street, Glasgow ; and Shawfield Works, Rutherglen, near Glasgow
1906	Trans.		Chrystall, Edwin Rodney, B.Sc. (Lond.), A.I.C., c/o Messrs. Curtis's and Harvey, Explosives Works, Cliffe-at-Hoo, Kent
1856	Trans.	C. 1876-80, 87-90	‖Church, Sir Arthur Herbert, K.C.V.O., M.A. and D.Sc. (Oxon.), F.R.S., F.I.C., Shelsley, Kew, Surrey
1903			Clacher, William, c/o Miss Cuthbert, 33, Upper Kelly-street, Greenock, N.B.
1888	Trans.		Claisen, Ludwig, Geh. Rath Prof., Ph.D. (Bonn), Augustastrasse 24, Godesberg-am-Rheim, Germany
1901	Trans.		Clark, Ernest, B.Sc. (Lond.), Royal Technical Institute, Salford ; and 16, Havelock-street, Sheffield
1892			Clark, Ernest Victor, Woodlands, St. Anne's-crescent, Lewes
1905			Clark, Friend Ebenezer, Prof., B.Sc. (Virg.), Ph.D. (Johns Hopkins), The Central University of Kentucky, Dannville, Ky., U.S.A.
1905			Clark, Thomas Walter Firth, 11, Quadrant-road, Canonbury, N.
1909	Trans.		Clarke, George, Department of Agriculture, Cawnpore, U.P., India
1908	Trans.		‖Clarke, Hans Thacher, A.I.C., Gayton-corner, Harrow
1910	Trans.		Clarke, Herbert Edmund, B.A. and B.Sc. (Oxon.), 20, Grosvenor-road, Jesmond, Newcastle-on-Tyne
1906	Trans.		Clarke, Reginald William Lane, F.I.C., 15, Torridon-road, Hither Green, S.E.
1905			Clarkson, George Douglas, King-street, Mirfield, Yorks.
1902			Claudet, Arthur Crozier, A.R.S.M., F.I.C., 6 and 7, Coleman-street, E.C.
1909	Trans.		Clayton, Arthur, B.Sc. (Lond.), 22, King's-road, Wimbledon, S.W.
1882	Proc.		Clayton, Edwy Godwin, F.I.C., 23, Holborn-viaduct, E.C.
1904			Clayton, Ellis, Hazeldene, Deerpark-road, Belfast
1893			Clayton, George, Northern College of Pharmacy, 100, Burlington-street, Manchester
1889			Clayton, John William, 3 and 5, Concert-street, Liverpool
1908			Clement, Leonard, B.A. (Cantab.), A.I.C., Beamsley, Fairhaven, near Lytham
1875			Clerk, Dugald, F.R.S., 18, Southampton-buildings, Chancery-lane, W.C.
1902			Clifford, William, Sewage Outfall Works, Wolverhampton
1878			Cloud, Thomas Charles, A.R.S.M., F.I.C., 479, Mansion House-chambers, E.C.

Date of Election.			
1907	Trans.		Clough, George William, B.Sc. (Birm.), 29, Oseney-crescent, N.W.
1902			Clough, William Thomas, A.R.C.S., Chelladene, St. Margaret's-road, Wanstead Park, Essex
1869	Trans.	C. 1885-90, 99-03	‖Clowes, Frank, Prof., D.Sc. (Lond.), F.I.C., The Grange, College-road, Dulwich, S.E.; and 40, Craven-street, Charing Cross, W.C.
1902			Clowes, George Henry Alexander, Ph.D. (Göttingen), Gratwick Research Laboratory, The University, Buffalo, U.S.A.
1897			Clutterbuck, Medwin Caspar, B.Sc. (Lond.), Ph.D. (Strassburg), 61, Beaconsfield-villas, Brighton
1905	Trans.		Coates, Joseph Edward, B.Sc. (Wales), The University, Edgbaston, Birmingham
1887			Coates, William Henry, M.A., M.B. and L.S.A. (Dun.), M.R.C.S., L.R.C.P. and L.S.A. (Lond.), 7, Albion-street, Hull
1896			Cobb, Walter William, M.A. (Oxon.), Hilton House, Atherstone
1890			Cobbold, Paul Alexander, M.A. (Cantab.), Haileybury, Ontario, Canada
1895			Coblentz, Virgil, Prof., Ph.D. (Berlin), 115-119, W. 68th-street, New York City, U.S.A.
1880			‖Cockburn, Arthur Cecil, Longfield Broom-road, Hampton Wick, Middlesex
1906			Cockburn, Charles Taylor, 34, Queen's-gate, Dowanhill, Glasgow
1895	Trans.		Cockburn, George Bertram, B.A. and B.Sc. (Oxon.), Ditchampton House, Wilton, Salisbury
1901			Cockburn, Thomas, F.I.C., 148, Woodstock-avenue, Shawlands, Glasgow
1892			Cockerill, Thomas, Technical College, Colombo, Ceylon
1893			Cocking, Allan Thomas, Carhampton House, Four Oaks, Sutton Coldfield
1888			‖Cocking, Lewis Smith, Rashcliffe Dyewood Mills, Huddersfield
1902			Cockle, Charles, Baslow, Hatherley-road, Winchester
1910			Cocks, Reginald Henry, M.A. (Oxon.), 14, Norbiton-avenue, Kingston-on-Thames
1909	Trans.		Cocksedge, Herbert Edwin, B.A. and B.Sc. (Oxon.), 26, Moss-road, Winnington, Northwich
1901			Coddington, Eustace, M.A. (Cantab.), 131, St. James's-road, Upper Tooting, S.W.
1903			Codling, Arthur John, 5, Tavistock-square, W.C.
1881			‖Coffin, Walter Harris, The National Liberal Club, Whitehall-place, S.W.
1885	Trans.	C. 1908-	Cohen, Julius Berend, Prof., Ph.D. (Munich), B.Sc. (Vict.), The University, Leeds

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901			‖Cohen, Robert Waley, M.A. (Cantab.), 11, Sussex-square, W.
907			Colebourn, William Arthur, 12, Grassfield-avenue, Grecian-street, Broughton, Manchester
891	Trans.		Colefax, Arthur, M.A. (Oxon.), Ph.D. (Strassburg), M.P., 4, Brick-court, Temple, E.C.
883			Coleman, Joseph Bernard, F.I.C., S.W. Polytechnic Institute, Manresa-road, Chelsea, S.W.
909			Coles, Alfred Bertram, M.A. (Oxon.), 42, Broadwater-road, Tottenham, N.
883			Collenette, Adolphus, Brooklyn, Fort-road, Guernsey
908			Collens, Archibald Edgar, Government Laboratory, Port of Spain, Trinidad
873			‖Collens, Edward, Stourbank House, Stourport, Worcs.
905	Trans.		Colles, William Morris, jun., B.Sc. (Lond.), Chemical Laboratory, School of Medicine, Cairo, Egypt
881			Collett, John Marton, Hillfield, Gloucester
910			Collett, Ronald Leslie, B.A. (Cantab.), A.I.C., Little Dawley, Hayes, Hayes End, Middlesex
885	Trans.	C. 1889-94,1900-1 V.P.1909-	‖Collie, John Norman, Prof., Ph.D. (Würzburg), F.R.S., F.I.C., 16, Campden-grove, Kensington, W.
1908	Proc.		Collier, William Henry, 12, Oxford-gardens, Bayswater, W.
1897			Collingridge, Frank, B.Sc. (Lond.), F.I.C., 73, Fountain-road, Edgbaston, Birmingham
1892			‖Collins, Hugh Brown, B.Sc. (Glas.), Auchinbothie Estate Office, Kilmacolm, S.O., Renfrewshire, N.B.
1890			‖Collins, Sydney Hoare, M.Sc. (Dun.), F.I.C., Armstrong College of Science, Newcastle-on-Tyne
1888			Collins, Walter Hepworth, Junior Constitutional Club, Piccadilly, W.
1905			Collitt, Bernard, c/o Messrs. Rose and Laflamme, Ltd., 400, St. Paul-street, Montreal, Canada
1887	Trans.		‖Colman, Harold Govett, D.Sc. (Vict.), Ph.D. (Würzburg), F.I.C., Elmside, Worcester Park, Surrey
1890			Colwell, James Kear, F.I.C., Clerkenwell Town Hall, Rosebery-avenue, E.C.
1900			Comber, Albert Walter, F.I.C., Dinwaed, Victoria-avenue, Southend-on-Sea
1892			‖Comyns, Frank, M.A. (Oxon.), Bryum, Craven-road, Newbury, Berks.
1899			Connah, James, B.Sc. (Lond.), F.I.C., The Laboratory, Custom House, E.C.
1875			Connor, Charles Cunningham, B.A. (Q.U.I.), 4, Queen's-elms Belfast

Date of Election.		
1883		‖Conrad, Edwin Charles, 34, Haslemere-road, Seven Kings, Ilfor
1906		Conyngham, William Boulton, Otter Works, Manchester
1875	Trans.	‖Cook, Ernest Henry, D.Sc. (Lond.), F.I.C., The Clifton Laboratory, 27, Berkeley-square, Clifton, Bristol
1895		Cook, Herbert William, B.Sc. (Lond.), The Technical Institut Tunbridge Wells, Kent
1907		Cook, Taylor, B.Sc. (Lond.), A.R.C.S., Burgh Academ Kilsyth, Glasgow
1890		Cooke, Arthur William, c/o Messrs. Brotherton and Co., Holme street, Dewsbury-road, Leeds.
1909		Cooke, Reginald Cyril Herbert, Salisbury Club, Salisbur Rhodesia, S. Africa
1888		Cooley, Walter Bromley, 5, Dudley-street, Wolverhampton
1909		Coope, John Charles Jesser, Union Club, Trafalgar-square, S.W.
1889		Cooper, Albert, 80, Gloucester-road, S. Kensington, S.W.
1898		‖Cooper, Albert John Bullen, 80, Gloucester-road, South Kensington, S.W.
1892		Cooper, Arthur James, B.A. (Dub.), B.Sc. (Lond.), F.I.C. Solihull School, Solihull, Birmingham
1888		Cooper, Astley, Stone, Greenhithe, Kent
1908		Cooper, Charles Duncan, 58, Spring-grove, Ipswich
1909		Cooper, George Stanley, Heaton House, Cleckheaton
1906		Cooper, Herbert Reginald, B.Sc. (Lond.), The Grammar School Witney
1904		Cooper, Jabez Horace, B.A. (Oxon.), 13, Victoria-terrace, Exete
1898		Cooper, John Burdon, M.D., B.S. and B.Sc. (Dun.), 22, Th Circus, Bath
1910		Cooper, Leonard Harry, Fern Lea, Trafalgar-drive, Lowe Bebington, Birkenhead
1900		Cooper, William Francis, B.A. (Cantab.), 7, Grosvenor-road Watford
1891		‖Cooper, Walter Johnson, The Elms, Lavernock, near Penarth
1894	Proc.	Coote, Arthur Herbert, B.Sc. (Lond.), Garwood, 36, Humber-road Blackheath, S.E.
1899	Trans.	Cope, Frank, Swindon Villa, Dewsbury
1890		‖Coppock, John Bridgeford, B.Sc. (Lond.), F.I.C., Lee-lane Horsforth, Leeds
1891	Trans.	Corbett, Charles Henry, The Avenue, Trowbridge, Wilts.
1901	Trans.	Cormack, William, Rainsford-road, Chelmsford
1888		‖Cornish, Vaughan, D.Sc. (Vict.), 157, Westbourne-grove, W.
1906		Cornwall, Reginald de Vere, Medical and Public Health Dept., Salisbury, Rhodesia, S. Africa

te of ection.		
90		Corrie, David, Nobel's Explosives Co., West Quarter Factory, Polmont Station, N.B.
93	Trans.	Coste, John Henry, F.I.C., Utopia, Gloucester-road, Teddington, Middlesex
09		Couch, David Little, 27, Wilmott-road, Leyton, N.E.
92		‖Couldrey, Henry, c/o Messrs. Thos. Cook & Son, Ludgate-circus, E.C.
05		Coupe, Miles, Rosebank, Thornfield-road, Waterfoot, near Manchester
06	Trans.	Courtauld, Stephen Lewis, B.A. (Cantab.), 2, Friars-walk, Burton-on-Trent
00		‖Courtman, Ernest Owen, Denford House, Atkins road, Clapham Park, S.W.
03		‖Cousins, Francis George, 16, Old Elvet, Durham
01	Trans.	Cousins, Herbert Henry, M.A. (Oxon.), Government Laboratory, Kingston, Jamaica
85		Cousins, William James, F.I.C., 17, Temple-chambers, Temple-avenue, E.C.
86	Trans.	‖Coutts, Francis James Henderson, M.D., B.Ch., B.Sc., and D.P.H. (Vict.), 48, Telford-avenue, Streatham Hill, S.W.
09	Proc.	Couzens, Edward Gordon, B.Sc. (Lond.), A.R.C.S., 47, Allfarthing-lane, Wandsworth, S.W.
10		Coventry, Bernard Okes, Imperial Forest Service, Dehra Dun, U.P., India
08		Coverdale, Arthur Edward, 68, Broad-street, Worcester
07	Trans.	Cowap, Matthewman Dalton, 15, Alexandra-road, St. John's Wood, N.W.
06	Trans.	Coward, Hubert Frank, D.Sc. (Manc.), Hulme Hall, Victoria-park, Manchester
98		Cowburn, Arthur William, 29, Princess-street, Manchester
08		Cowburn, John Robert, 10, Eastwood-road, South Woodford, Essex
82		‖Cowie, Thomas Rennie, Garnkirk House, Garnkirk, N.B.
05		Cowie, William Beaverly, 26, East Claremont-street, Edinburgh
08		Cowley, Robert Charles, College of Pharmacy, Brisbane, Queensland, Australia
98		Cowling, Frederick, Technical Schools, Clay Cross, near Chesterfield
05		Cowman, Douglas Henry Bellars, Heathville-corner, Gloucester
04		Cowper, Alfred Denys, B.Sc. (Lond.), 8, Sandown-terrace, Deal, Kent
88		Cowper, Joseph, 50, King-street, Penrith
98		Cox, Frederick Hudson-, F.I.C., 67, St. Thomas'-street, Weymouth
73		Cox, Samuel Herbert, 13, St. Helen's-place, E.C.
04		Crabb, William, B.Sc. (Lond.), 5, Edridge-road, Croydon

Date of Election.			
1870	Trans.		Crafts, James Mason, Prof., 111, Commonwealth Avenue, Bosto Mass., U.S.A.
1897	Trans.		Craig, Andrew William, College of Pharmacy, 360, Swansto street, Melbourne, Victoria
1897			Cranfield, William, The Higher Grade Board School, Halifax
1897			Creasey, Clarence Hamilton, 34, Palm-grove, Oxton, Birkenhe
1909	Trans.		Creighton, Henry Jermain Maude, M.A. (Dalhousie), M.S (Birm.), bei Prof. Bredig's Laboratorium, Polytechniku Chemiegebäude, Zurich, Switzerland
1909			Crewe, Philip Henry, c/o Messrs. Dakin Bros., Ltd., 8 Middlesex-street, E.
1887			‖Cribb, Cecil Howard, B.Sc. (Lond.), F.I.C., 136, Shaftesbur avenue, W.
1878			‖Criper, William Risdon, A.R.S.M., F.I.C., Chemical Work Konnagar, Calcutta, India
1907			Crisp, George Hugh, M.A. (Oxon.), B.Sc. (Lond.), 10, Gainsbor road, Crewe
1906			Crocker, Henry Ernest, 2, Reservoir-road, Erdington, Birmingha
1902	Trans.		Crocker, James Codrington, M.A. (Cantab.), D.Sc. (Lond.), Sou Western Polytechnic, Manresa-road, Chelsea, S.W.
1901			Crocker, Walter Stevens, A.R.C.S., 39, Arnold-street, Princes Par Liverpool
1897	Trans.		Crofts, James Murray, M.A. (Cantab.), B.Sc. (Lond.), Kelvi side, Fogg-Lane, Didsbury, Manchester
1907			Croghan, Edward Henry, Laboratory, Simmonds-street, Johanne burg, S. Africa
1886	Trans.		‖Crompton, Holland, Oaklyn, Cross Oak-road, Berkhamsted
1902			Crookes, Henry, 109, Ladbroke-grove, Notting Hill, W.
1901	Trans.		Crookes, Samuel Irwin, Marama-avenue, Owen's-road, Epsom Auckland, New Zealand
1857	Trans.	C. 1866-70 V.P. 76-9, 85-7 P. 87-9	‖Crookes, Sir William, O.M., D.Sc. (Oxon., R.U.I., Cape of Goo Hope), Hon. LL.D. (Birm.), F.R.S., F.I.C., 7, Kensington Park gardens, W.; and Athenæum Club, Pall Mall, S.W.
1879	Trans.	C. 1890-1, 93-5	‖Cross, Charles Frederick, B.Sc. (Lond.), F.I.C., 3, New-cour Carey-street, W.C.
1890	Trans.	C. 1901-2 S. 1905–	‖Crossley, Arthur William, Prof., D.Sc. (Vict.), Ph.D. (Würzburg F.R.S., F.I.C., Pharmaceutical Society, 17, Bloomsbury-squar W.C.; and 10, Crediton-road, West Hampstead, N.W.
1896			Crossman, Charles Matthew, B.Sc. (Lond.), Cannon Hous Watford, Herts.
1895			Crossman, Tom, 70, Stonefall-avenue, Starbeck, Harrogate
1898			Crouch, William Samuel, Hersham, Walton-on-Thames
1880	Trans.		Crow, John Kent, D.Sc. (Lond.), F.I.C., Ivydene, Westcomb park-road, Blackheath, S.E.

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87		‖Crowther, Horace Woodward, F.I.C., The Beeches, West Bromwich
95		Croysdale, John, Whitley Bridge, S.O., Yorks.
84		Crumbie, William Drake, 146, Washington-street, East Orange, N. J., U.S.A.
10	Trans.	Cumming, Alexander Charles, D.Sc. (Melbourne), Chemistry Department, The University, Edinburgh
87	Trans.	Cundall, James Tudor, B.Sc. (Lond.), F.I.C., Edinburgh Academy, Henderson-row, and 1, Dean-park-crescent, Edinburgh
04		Cunningham, James Edward, Minas Peña del Hierro, Provincia del Huelva, Spain
07		Cunningham, John Arthur, Prof., M.A. (Cantab.), B.A. (R.U.I.), A.R.C.S.I., The Observatory, Alipore, Calcutta; and Presidency College, Calcutta, India
75		Curphey, William Salvador, F.I.C., 4, Ransworth-mansions, Compayne-gardens, South Hampstead, N.W.
00		Cussons, John, B.Sc. (Vict.), P.O., Fauresmith, Orange River Colony, S. Africa
81		‖Custance, John D., Prof., Broad View, Georgetown, S. Australia
95		Cuthbertson, Lionel Mould Gurney, 89, Lordship Park, N.
94		Dains, Herbert Henry, F.I.C., 7, Mount View-road, Crouch Hill, N.
01	Trans.	Dakin, Henry Drysdale, D.Sc. (Vict.), F.I.C., 819, Madison-avenue, New York, U.S.A.
07		Dall, Colin Ernest, B.Sc. (Lond.), 26, Beaconsfield-avenue, Charlton, Dover
95		Dallman, Arthur Augustine, Lyndhurst, Prospect-vale, Liverpool
94		Dalton, William Herbert, 85, Hayter-road, Brixton Hill, S.W.
0		Dand, Middleton Henry, The Brewery, Steyning, Sussex
01	Trans.	Daniel, Gilbert Howard, B.Sc. (Lond.), 25, Church-walk, Ulverston
7		Daniell, Louis Charles, Royal Standard Brewery, Tamworth, N.S.W.
2	Trans.	Darbishire, Francis Vernon, B.A. (Oxon.), Ph.D. (Leipzig), South Eastern Agricultural College, Wye, Kent
2		Darby, Stephen, F.I.C., Cookham Dean, Berks.
9		Darling, Charles Robert, A.R.C.S.I., F.I.C., Bryniach, Brent-road, Plumstead, Kent
1		Darling, Thomas, Adderstone House, Berwick-on-Tweed
1	Trans.	‖Darling, William Howarth, F.I.C., 26, Dover-street, Manchester
5		‖Davey, G. William, 22, Tubbs-road, Harlesden, N.W.

Date of Election.		
1905		Davey, Joseph Morgan, Shelone House, Briton Ferry, Glam.
1897		Davidge, Henry Norris, 23, Rydal-road, Streatham, S.W.
1900		Davidson, Alexander, jun., F.I.C., 173, Colinton-road, Edinburg
1906		Davidson, Charles, 65, Cadder-street, Pollokshields, Glasgow
1907		Davidson, Francis, 283, Ecclesall-road, Sheffield
1876		‖Davidson, Joseph, Green Bank, Holywell-green, Halifax
1898	Trans.	Davidson, William Brown, M.A. and D.Sc. (Aberd.), Ph. (Würzburg), F.I.C., Saltley Gas Works, Birmingham
1866	Trans.	‖Davies, Arthur Ellson, Ph.D., Tweedbank, West Savile-roa Edinburgh
1858	Trans.	Davies, Edward, The Laboratory, 28, Chapel-street, Liverpool
1905		Davies, John Llewelyn, M.A. (Cantab.), The Perse Schoo Cambridge
1896		Davies, Llewellyn John, Bute-chambers, Bute-road, Cardiff
1894		Davies, Samuel Henry, B.Sc. (Vict.), Rowntree's Cocoa Work York
1900		Davis, Arthur Charles, 2, Downing-grove, Cambridge
1902		Davis, Charles Benson, c/o Dr. Francis Wyatt, S.W.-corne 23rd-street and 9th-avenue, New York City, U.S.A.
1902		Davis, Frederick, B.Sc. (Vict.), Prospect House, Wiswell, ne Whalley, Blackburn
1902		Davis, Henry Wilson, F.I.C., Farleigh, Crescent-road, Kingst Hill, S.W.
1857		‖Davis, J. Frederick, c/o J. Lewis, Esq., Government Laborator Parliament-street, Cape Town, S. Africa
1872	Trans.	‖Davis, Richard Hayton, 23, Regent-parade, Harrogate
1876		‖Davis, Walter Charles, The Chestnuts, Durdham Down, Bristol
1897	Trans.	Davis, William Alfred, B.Sc. (Lond.), 2, Ashgrove-roa Bromley, Kent
1900		Davison, Thomas Cuthbert, Bower-hill, Exmouth-stree Swindon
1906		Davson, Archibald Prideaux, A.R.C.S., A.I.C., 22, Chatswort gardens, Acton, W.
1900	Trans.	Dawson, Harry Medforth, D.Sc. (Leeds), B.Sc. (Lond.), Ph. (Giessen), The University, Leeds; and 25, St. Michael crescent, Headingley, Leeds
1909		Dawson, James Ferguson, B.Sc. (Manc.), Glencoe House, Tarbe Loch Fyne, N.B.
1890		Day, Charles Edwin, B.Sc. (Edin.), The Mines, Conisto Lancs.
1881	Trans.	‖Day, Thomas Cuthbert, 36, Hillside-crescent, Edinburgh
1905		Day, William Walpole, B.Sc. (Wales), Llandilo, Attleboroug road, Nuneaton

Date of Election.			
1907			Dealy, Thomas Kirkman, Craigmin East, Magazine Gap, Hong Kong, China
1901	Trans.		Dean, George, M.A. (Cantab.),38, Brisbane-road, Ilford, E.
904			Deane, Harold, B.Sc. (Lond.), F.I.C., St. Olave's, Sudbury, Suffolk
1886			Deane, Leopold Mandeville, 21, Station-terrace, Abbey Village, near Chorley, Lancs.
1859		V.P. 1871-4	Debus, Heinrich, Prof., Ph.D. (Marburg), F.R.S., Schlangenweg 4, Cassel, Provinz Hessen, Germany
1898	Trans.		‖De Castro, John Paul, M.A. (Cantab.), F.I.C., 1, Essex-court, Temple, E.C.
1885	Trans.		Dechan, Martin, F.I.C., Laboratory of Public Analyst, Hawick
1903			Deeks, William Thomas, High-street, Shanklin, Isle of Wight
869	Trans.		‖Deering, William Henry, I.S.O., F.I.C., 3, Broad-park-avenue, Ilfracombe
900	Proc.		Deerr, Noël Fielding, Experiment Station, Hawaian Sugar Planters' Association, Honolulu, H.I., U.S.A.
902			De la Rue, Evelyn Andros, B.A. (Oxon.), 110, Bunhill-row, E.C.
905			De Lury, Ralph Emerson, M.A. and Ph.D. (Toronto), The Dominion Astronomical Observatory, Ottawa, Canada
907	Trans.		Denham, William Smith, B.Sc. (Lond.), F.I.C., The United College, St. Andrews
892			Denison, Joseph Richard, c/o Messrs. Denison, Preussner & Co., Valley Dyeworks, Bradford
902			Dennis, William, Saxilby, Lincoln
906			Denton, John, Crossley Hall, Bradford
903	Trans.		Desch, Cecil Henry, D.Sc. (Lond.), Ph.D. (Würzburg), F.I.C., Metallurgical Laboratory, The University, Glasgow
897			‖Deverell, Louis Charles, Brantwood, Shortlands-grove, Shortlands, Bromley, Kent
870	Trans.	C. 1874-7 V.P. 80-3 86-8, 96-7 P. 97-9	‖Dewar, Sir James, Prof., M.A. (Cantab.), Hon. LL.D. (St. Andrews, Aberd., Edin., Glas.), Hon. D.Sc. (Oxon., Dub., Vict., Ireland), F.R.S., F.I.C., Royal Institution, Albemarle-street, W.
899			Dewhirst, John Arthur, F.I.C., 13, Highfield-terrace, Nab Wood, Saltaire, Bradford
880			Dibdin, William Joseph, F.I.C., 2, Edinburgh-mansions, Howick-place, Victoria-street, S.W.
872			‖Dickinson, Arthur John, F.I.C., 178, Lewisham-high-road, Brockley, S.E.
908	Trans.		Dickinson, Cyril, B.Sc. (Vict. and Leeds), F.I.C., Southwark Town Hall, Walworth-road, S.E.
898			Dickson, Samuel, Chemical Laboratory, 2, Broadway, Westminster, S.W.

Date of Election.			
1910			Dickson, Thomas William, B.A. Oxon.), 153, Finborough-road, South Kensington, S.W.
1906			Dickson, William, Viewfield, Linlithgow, N.B.
1907			Dikshit, Mohan Nath Kedarnath, Amliran, Surat, India
1906			Dinwoodie, James Herbert, 71, Bree-street, Johannesburg, S. Africa
1860	Trans.	C.1873-4 V.P. 1900-03	‖Divers, Edward, Prof., M.D. and Hon. D.Sc. (R.U.I.), F.R.S., F.I.C., 3, Canning-place, Palace Gate, W.
1897			Dixon, Andrew James, F.I.C., 97, Pitt-street, Sydney, N.S.W.
1885	Trans.	C. 1900-06	Dixon, Augustus Edward, Prof., M.D. (Dub.), Queen's College, and Fernhurst-avenue, Western-road, Cork
1896	Trans.		Dixon, Frank, B.Sc. (Lond.), The Institute, Lydney, Gloucester
1894	Proc.		‖Dixon, George, Major, M.A. (Cantab.), Trinity College, Cambridge and St. Bees, S.O., Cumberland
1876	Trans.	C.1892-6 V.P. 1904-7 P.1909-	‖Dixon, Harold Baily, Prof., M.A. (Oxon.), Hon. Ph.D. (Prague), F.R.S., The University, Manchester
1893			Dixon, Harry William, 32, Grange-view, Chapeltown-road, Leeds
1895			Dixon, William, 102, Spring-street, Bury
1862			Dixon, William Adam, F.I.C., 97, Pitt-street, Sydney, N.S.W.
1882	Trans.	C.1901-6 V.P. 1907-	Dobbie, James Johnston, Prof., M.A. (Glas.), D.Sc. (Edin.), F.R.S., F.I.C., 4, Vicarage-gate, Kensington, W.
1887	Trans.		Dobbin, Leonard, Ph.D. (Würzburg), F.I.C., Chemical Laboratory, New University-buildings, Edinburgh
1910			Dodd, Alexander Scott, B.Sc. (Edin.), A.I.C., 173, Bruntsfield-place, Edinburgh
1898			‖Dodd, Frederick Robertson, F.I.C., Welbank-villas, Liverpool-road, Aughton, Ormskirk
1901			Dodd, Robert, 56, Valley-road, Streatham, S.W.
1886			Dodd, W. Ralph, Trederwen, Village-road, Enfield, Middlesex
1892			Dodds, George Price, 14, St. Luke's-terrace, Darlington
1905			Dodds, Roger, Kingswood School, Bath
1897	Proc.		Dodgson, John Wallis, B.Sc. (Lond.), University College, Reading
1894	Proc.		Doherty, William Michael, F.I.C., Government Laboratory, Sydney, N.S.W.
1905			Donald, Robert, M.A. and B.Sc. (N.Z.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), D.P.H. (Oxon.), Mental Hospital, Orokonui Home, Waitati, New Zealand
1892			Donaldson, Hudson, The Laurels, St. Catharine's-road, Grantham
1901	Trans.		Donnan, Frederick George, Prof., M.A. (R.U.I.), Ph.D. (Leipzig), Muspratt Laboratory, The University, Liverpool
1897	Trans.		Dootson, Frederick William, M.A. (Cantab.), D.Sc. (Dub.), F.I.C., University Chemical Laboratory, Cambridge

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902	Trans.	Dorée, Charles, M.A. (Oxon.), D.Sc. (Lond.), 58, Gore-road, N.E.
899		Dougall, James Dick, Senhouse-street, Maryport, Cumberland
888		‖Douglas, William, F.I.C., Diamond, Demerara, British Guiana
905		Doull, John, 22, Lauriston-place, Edinburgh
884		Down, Frederick Johnathan, Glengariff, Milton-road, Harpenden, Herts.
899		Doyle, Frederick, Oakdene, Scotland-road, Slanwix, Carlisle
884		Draper, Henry Carter, St. Kevin's, Sorrento-road, Dalkey, Co. Dublin
891	Proc.	Dreaper, William Porter, F.I.C., 68, Victoria-street, S.W.
893		Dreyfus, Charles, Ph.D., The Clayton Aniline Co., Clayton, Manchester
902		Drought, James Justinian, Molo, *viâ* Mombasa, British East Africa
895		Druce, Edric, County Agricultural Institute, Ridgmont, Aspley Guise, S.O., Beds.
904	Trans.	Drugman, Julien, Ph.D. (Bonn), 117, Rue Gachard, Brussels, Belgium
897		Duckham, Alexander, Phœnix Wharf, West Ferry-road, Millwall, E.
908		Duckworth, Hugh Cecil, Elmstead, Twickenham
907		Duckworth, Samuel, M.Sc. (Vict.), 81, Regent-road, Salford, Manchester
901		Duckworth, William Henry, Weaste House, Borough-road, Salford
890		‖Dudley, William Lofland, Prof., Vanderbilt University, Nashville, Tenn., U.S.A.
892		Duffield, Walter William, 5, Ashington-road, Hurlingham, Fulham, S.W.
893	Trans.	‖Dufton, Samuel Felix, M.A. (Cantab.), D.Sc. (Lond.), Laurel Bank, Claremont-road, Headingley, Leeds
884		Duggan, Thomas Richard, F.I.C., 60, Foyle-road, Blackheath, S.E.
889		Duisberg, Carl, Prof., Ph.D., Elberfeld, Germany
889		‖Dukes, Thomas William, P.O. Box 10, Vrijheid, S. Africa
881		Duncan, Arthur William, c/o Messrs. Jas. Woolley, Sons & Co., Ltd., Victoria Bridge, Manchester
894	Proc.	‖Duncan, Cecil Cooke, F.I.C., The Shire Hall, Worcester
906		Duncan, Robert Kennedy, Prof., University of Kansas, Lawrence, Kansas, U.S.A.
891		Duncan, William, F.I.C., The Laboratory, 65, Bath-row, Edgbaston, Birmingham
896		Duncan, William, Royal Dispensary, 21, West Richmond-street Edinburgh
905		Dunlop, Harry, c/o Messrs. R. R. Tatlock and R. T. Thomson, 156, Bath-street, Glasgow

Date of Election.			
1909	Trans.		||Dunlop, John Gunning Moore, Caius College, Cambridge
1894	Proc.		||Dunn, Frederic, 193, Collins-street, Melbourne, Australia
1909	Trans.		Dunn, Frederick Percy, B.Sc. (Lond.), Haresfield, Chorley Wood Rickmansworth, Herts.
1882			Dunn, John Thomas, D.Sc. (Dun.), F.I.C., 10, Dean-street Newcastle-on-Tyne
1908			Dunnicliff, Horace Barratt, Prof., B.A. (Cantab.), B.Sc. (Lond.) Mohammedan Anglo-Oriental College, Aligarh, U.P., Indi
1909			Dunningham, Alfred Charles, B.Sc. (Lond.), Sir John Deane' Grammar School, Northwich
1893			Dunnington, Francis Perry, University of Virginia, Charlottesville U.S.A.
1899			Dunscombe, Frederick Charles, c/o Electric Reduction Co. Buckingham, Quebec, Canada
1901	Trans.		Dunstan, Albert Ernest, D.Sc. (Lond.), East Ham Technica College, East Ham, E.
1885			Dunstan, Malcolm James Rowley, M.A. (Oxon.), F.I.C., Th College, Wye, Kent
1905			Dunstan, Sydney, The Royal Infirmary, Newcastle-on-Tyne
1879	Trans.	C. 1888-91 S. 1893-03 V.P. 1903-06	||Dunstan, Wyndham Rowland, Prof., Hon. M.A. (Oxon.), Hon. LL.D. (Aberd.), F.R.S., F.I.C., Imperial Institute, S.W.
1907			Dupré, Frederick Harold, St. Maur, Benhill Wood-road, Sutton, Surrey
1907			Dupré, Percy Vivian, A.C.G.I., F.I.C., St. Maur, Benhill Wood-road, Sutton, Surrey
1871			||Durham, Henry, 13, Coleherne-road, South Kensington, S.W.
1906			Durrans, Thomas Harold, B.Sc. (Lond.), 1, Cornwall-terrace, Regent's Park, N.W.
1883	Trans.		Durrant, Reginald Graham, M.A. (Oxon.), The College, Marlborough, Wilts.
1908			Dutt, Bidhu Bhushan, Prof., M.A. (Calcutta), Presidency College, Calcutta, India
1907			Dutton, Francis Bridger, Birch Hall, Windlesham, Camberley
1892			Duxbury, Thomas, 17, Grosvenor-chambers, Deansgate, Manchester
1909			Dyche-Teague, Francis Clifford, B.Sc. (Birm.), 28, King-street, Portman-square, W.
1875	Trans.	C. 1892-7 1904-08	||Dyer, Bernard, D.Sc. (Lond.), F.I.C., 17, Great Tower-street, E.C.
1890	Trans.		Dymond, Thomas Southall, F.I.C., Board of Education, South Kensington, S.W.
1883	Trans.		||Dyson, Septimus, 12, Fairmile-avenue, Streatham, S.W.

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905		Eade, Samuel George, 35, Blackborough-road, Reigate
908	Trans.	Eagles, Edwin Mortimer, M.A. (Cantab.), The Grammar School, Enfield, Middlesex
876		‖Earp, Francis Salsbury, Ph.D. (Giessen), F.I.C., 35, Porter-street, Kalgoorlie, W. Australia
907		Eastaugh, Frederick Alldis, A.R.S.M., The University, Sydney, N.S.W.
889	Trans.	‖Easterfield, Thomas Hill, Prof., M.A. (Cantab.), Ph.D. (Würzburg), F.I.C., Victoria University College, Wellington, New Zealand
891		Eastick, Charles E., Martineau's Refinery, King Edward-street, Whitechapel, E.
881		‖Eastick, John Joseph, A.R.S.M., F.I.C., 49a, Clapton Common, N.E.
1908		Easton, Reginald Freeman, 38, Edith-road, West Kensington, W.
1903		Eastwood, Arthur William, B.A. (Cantab.), Newton College, Newton Abbot
1906		Eaton, Bertie James, A.I.C., Institute of Medical Research, Kuala Lumpur, Selangor, Federated Malay States
1878	Trans.	‖Eccles, Herbert, Briton Ferry Steel Works, Briton Ferry, Glamorganshire
1909		Edgar, Edward Charles, Dalegarth, Romiley, Stockport
1909		Edge, Alfred, Ravenhurst, Clayton Bridge, Manchester
1909		‖Edge, John Harold, Great Marld, Smithills, Bolton
1906		Edgell, Cecil Wyatt-, B.A. (Oxon.), King's School, Warwick
1903	Proc.	Edgerton, John Percy, St. Lawrence House, 96, Cheapside, E.C.
1902		Edlin, Edgar Leeder, B.A. (Oxon.), 36, Grant-road, Addiscombe, Croydon
1902		Edminson, Sidney Robert, B.Sc. (Lond.), Maritzburg College, Natal, S. Africa
1909		Edwards, Frederick Watson, 64, Coppice-side, Swadlincote, Burton-on-Trent
1893		Edwards, Thomas, Ty Mawr, Rhymney, viâ Cardiff
1884		Edwards, Vincent, F.I.C., c/o Lawes' Chemical Manure Co., Barking Creek, Essex
1892		Edwards, Walter Nicholas, 6, Shardcroft-avenue, Herne Hill, S.E.
1898		‖Edwards, Wilbraham Tollemache Arthur, M.R.A.C., F.I.C., The Laboratory, Phœnix, Mauritius
1909	Trans.	Egerton, Alfred Charles Glyn, B.Sc. (Lond.), Chilton House, Thame
1887		‖Ehrhardt, Ernest Francis, D.Sc. (Lond.), Ph.D. (Munich), B.Sc. (Birm.), Badische Anilin und Soda Fabrik, Ludwigshafen-am-Rheim, Germany
1899		Eichenauer, William Frederick, 18, Maryon-road, Old Charlton, Kent

Date of Election.		
1883		‖Ekins, Arthur Edward, J.P., F.I.C., Rushden, Lattimore-road, St. Albans
1903		Elford, Archibald Sefton, M.A. (Oxon.), 41, Broomfield-road, Chelmsford
1891		Elford, Percy, M.A. (Oxon.), 115, Woodstock-road, Oxford
1907		Elias, Owen Aubrey, 123, Waller-road, New Cross, S.E.
1878	Trans.	‖Elliott, Arthur Henry, Ph.D. (Columbia), 165, Broadway, New York City, U.S.A.
1896	Trans.	Elliott, Walter John, M.A. (Cantab.), Woodcroft, Lichfield-road, Stafford
1893		Ellis, Charles Sordes, F.I.C., Meadowlead, Station-road, Harrow
1900		Ellis, Frederic Richard, 146, Ashley Down-road, Bristol
1903	Proc.	Ellis, Henry Russel, B.Sc. (Lond.), 179, Warwick-road, Kensington, W.
1878		Ellis, William Hodgson, Prof., M.A. (Cantab.), M.B. (Toronto), F.I.C., School of Practical Science, Toronto, Canada
1892		Ellison, Henry, jun., Whitechapel-road, Cleckheaton
1893		Elmore, Alexander Stanley, 72, Gloucester-terrace, Hyde Park, W.
1902	Proc.	Elsden, Alfred Vincent, B.Sc. (Lond.), F.I.C., Chemical Department, Royal Arsenal, Woolwich, S.E.
1885		Embrey, George, F.I.C., City and County Laboratory, 47, Park-road, Gloucester
1887		‖Emmons, Hamilton, The Copse, Hamble, Southampton
1910		Emslie, Benjamin Leslie, 1105, Temple-building, Toronto, Canada
1901		English, Robert, Christchurch Gas Co., Christchurch, New Zealand
1892		Entwistle, Herbert, 1, Albert-place, Dickenson-road, Longsight, Manchester
1899		Epps, James Washington, 159, King's-avenue, Clapham Park, S.W.
1889		Erskine, James Kerr, New Kleinfontein Co., Ltd., Post Office, Benoni, Transvaal, S. Africa
1883	Trans.	Esilman, Alexander, Fleetwood Lodge, 25, Roe-lane, Southport
1909		Essex, Harry, jun., 23, Bescot-street, Walsall
1862		‖Esson, William, Prof., M.A. (Oxon.), F.R.S., Merton College, Oxford
1865		‖Estcourt, Charles, F.I.C., Seymour House, Seymour-grove, Old Trafford, Manchester
1899		‖Estcourt, Harry Estcourt, 467, West-street, Durban, Natal, S. Africa
1888		‖Estcourt, Philip Anderson, F.I.C., Seymour House, Seymour-grove, Old Trafford, Manchester

Date of Election.		
1894		Eumorfopoulos, Nicholas, B.Sc. (Lond.), 24, Pembridge-gardens, W.
1905		Evans, Bernard Scott, B.Sc. (Lond.), A.I.C., 42, Keymer-road, Streatham, S.W.
1904		Evans, Edward, The Laboratory, South Metropolitan Gas Co., 709, Old Kent-road, S.E.
1891		Evans, Frederick Arthur, The Cape Copper Co., Ookiep, Namaqualand, Cape of Good Hope, S. Africa
1906		Evans, Frederick Watkins, 11, High-street, Cardigan
1904		Evans, John, F.I.C., 67, Surrey-street, Sheffield
1904		Evans, Nevil Norton, McGill University, Montreal, Canada
1892	Trans.	‖Evans, Robert Cecil Turle, M.B. and B.S. (Lond.), M.R.C.S. (Eng.), L.R.C.P., L.S.A., D.P.H. and B.Sc. (Lond.), Sandringham House, Marine-crescent, Herne Bay, Kent
1888		‖Everard, Arthur George, 43, Clapham-road, S.W.
1910		Everest, Arthur Ernest, B.Sc. (Birm.), Clifton House, Shrewbury
1908		Everitt, Charles, M.A. (Oxon.), 67, Boston-Avenue, Southend-on-Sea
1902		Everitt, Walter, Norwood Wharf, Southall, Middlesex
1894		Evershed, Frank, Kenley, Surrey
1896	Trans.	Ewan, Thomas, M.Sc. (Vict.), Ph.D. (Munich), c/o Cassel Cyanide Co., Ltd., Shuna-street, Maryhill, Glasgow
1909	Trans.	Ewins, Arthur James, B.Sc. (Lond.), 144, Ribblesdale-road, Streatham, S.W.
1902	Trans.	Eynon, Lewis, B.Sc. (Lond.), F.I.C., 57, Darenth-road, Stamford Hill, N.
1901	Trans.	Eyre, John Vargas, Ph.D. (Leipzig), 26, Bridge-road-west, Battersea Park, S.W.

1888		Faber, Harald Nicolai, 7 and 8, Idol-lane, E.C.
1904		Fagan, Thomas Wallace, M.A. (Cantab.), Edinburgh and East of Scotland College of Agriculture, 13, George-square, Edinburgh
1908		Fairburn, Henry, Eastholme, Northallerton
1865	Trans.	‖Fairley, Thomas, F.I.C., 17, East-parade, Leeds
1895		Fairrie, Henry, 253, Vauxhall-road, Liverpool
1899		Fairweather, Ernest Barratt, King's College Hospital, Lincoln's Inn Fields, W.C.
1908		Fairweather, James Hill, 62, Wythes-road, Silvertown, E.
1908		Falk, Kaufman George, B.Sc. (Columbia), Ph.D. (Strassburg), Hotel Westminster, Copley-square, Boston, U.S.A.
1888		Farlie, John Burke, 54, Wellington-road, Old Charlton, Kent
1906		Farmer, Charles George Edgar, 16, Herbert-crescent, S.W.

Date of Election.			
1907			Farmer, John Edwin, Blelsoe, New-road, Mitcham Junctio Surrey
1903	Trans.		Farmer, Robert Crosbie, D.Sc. (Vict.), Ph.D. (Würzburg Warbreck, Mount-road, Upton, Bexley Heath, Kent
1895			Farr, Edward Henry, Uckfield, Sussex
1910			Farrands, Harry, M.A. (Oxon.), The College, Isleworth
1870			‖Farries, Thomas, F.I.C., 16, Coleman-street, E.C.
1880			‖Farrington, Thomas, M.A. (Q.U.I.), F.I.C., 4, Waterlo place, Cork
1907			Fawcitt, Claude Scott, 11, St. Mark's-road, Bangalore, India
1887			Fawsitt, Charles Albert, 9, Foremount-terrace, Dowanhill, Glasgo
1903	Trans.		Fawsitt, Charles Edward, Prof., D.Sc. (Edin.), Ph.D. (Leipzig The University, Sydney, N.S.W.
1906	Proc.		Feilmann, Martin Ernest, B.Sc. (Lond.), Ph.D. (Bâle), F.I.C 92, Victoria-street, S.W.
1897	Trans.		Fenby, Alarick Vincent Colpoys, B.Sc. (Lond.), Somervill Woodland-grove, Yeovil
1878	Trans.	C. 1898-1902	‖Fenton, Henry John Horstman, M.A. and Sc.D. (Cantab.), F.R.S. F.I.C., Christ's College, and 19, Brookside, Cambridge
1898			Ferguson, James Edward, Laboratory and Assay Office, 2, Unio court, Old Broad-street, E.C.
1872		C. 1889-93	‖Ferguson, John, Prof., M.A. (Glas.), LL.D. (St. Andrews F.I.C., The University, Glasgow
1901			Ferguson, Reginald Williams, B.Sc. (Lond.), A.R.C.S., 57, Linde road, Bournville, Birmingham
1899			Fermor, Herbert Frederick Francis Burdett, 32, Trossacks-roa East Dulwich, S.E.
1909	Trans.		‖Ferraboschi, Frederic, B.A. (Cantab.), 21, Lawrie-park-roa Sydenham, S.E.
1902			Ferrand, Frederick, 13, Torrington-street, Hopwood, Heywood
1882			Ferrier, James, P.O. Box 764, Rome, Georgia, U.S.A.
1905			Ferrier, John Greig, 6, Brunswick-square, Port of Spain, Trinidad West Indies
1902			Ferrier, John Oliver, c/o Compagnie Française des Phosphat de l'Océanie, Papcete, Tahiti
1902			Ferris, Percy James, Gorse Bank, Thursaston-road, Heswall Cheshire
1906			Field, Samuel, A.R.C.S., Northampton Polytechnic Institut Clerkenwell, E.C.
1904			Field, William Eddington, Martin-street, Elsternwick, Melbourne Australia
1895			Fielding, Patrick Joseph Dominick, 66, Patrick-street, Cork
1906	Trans.		Fierz, Hans Eduard, Ph.D. (Zürich), Farben-Extractfabriken, vorm J. R. Geigy, Bâle, Switzerland

e of ction.			
0	Trans.		Findlay, Alexander, M.A. and D.Sc. (Aberd.), Ph.D. (Leipzig), The University, Edgbaston, Birmingham
8			Findley, Albert Edward, B.Sc. (Birm.), 1, Welford-road, Handsworth, Birmingham
5			Findon, Frank Standish, Rev., M.A. and B.Sc. (St. Andrews), 41, Great Percy-street, Holford-square, W.C.
4			Finlow, Robert Steel, B.Sc. (Wales), c/o Messrs. Grindlay and Co., Calcutta, India
5	Trans.		Finnemore, Horace, B.Sc. (Lond.), F.I.C., High Leasow, Coulsdon, S.O., Surrey
7			Fischer, Eugen, Ph.D. (Zürich), c/o Messrs. Kalle & Co., Aktiengesellschaft, Biebrich-am-Rheim, Germany
6			Fisher, Ernest Hunter, The County Laboratory, St. Albans
2	Trans.		‖ Fisher, Walter William, M.A. (Oxon.), F.I.C., 5, St. Margaret's-road, Oxford
3			Fison, Edward Herbert, Stoke House, Ipswich
2			Fison, Sir Frederick William, Bart., M.A. (Oxon.), 64, Pont-street, S.W.
6			Fitzgerald, Anthony Nisbet, B.A. and B.Sc. (Lond.), 12, St. Mary's-road, Strood, Rochester
9			Flack, Edmund Victor, Mayville, Wigtown-road, Green Point, Cape Town, S. Africa
6			Fleet, John Thomas, 24, Sheep-street, Rugby
9	Trans.		‖ Fleischmann, Friedrich Noël Ashcroft, M.A. (Oxon.), 37, Palace-court, Bayswater, W.
8			‖ Fleming, John Arnold, Woodburn, Rutherglen, Glasgow
4			Fletcher, Frederick William, North London Chemical Works, Holloway, N.; and Beauchamp Lodge, Enfield
5		C. 1893-4	‖ Fletcher, Lazarus, M.A. (Oxon.), F.R.S., Natural History Department, British Museum, Cromwell-road, S.W.; and 35, Woodville-gardens, Ealing, W.
4			‖ Flintoff, Robert John, Haxby, York
2			Floris, Robert Brooke, F.I.C., Heathwood, Woodside-road, Beaconsfield, Bucks.
6	Trans.		Flürscheim, Bernhard, Ph.D. (Heidelberg), Rushmoor, Fleet, Hants.
4			Fogg, Charles Albert, Graythorne, Albert-road, Bolton
9			Fogg, Thomas, 93, Portsdown-road, Maida Vale, W.
9			Foggie, John, University College, Dundee
2			Foll, Edgar, The Cottage, The Lion Brewery, Belvedere-road, Lambeth, S.E.
5			Follows, Harold, 4, Kensington-avenue, Victoria-park, Manchester
4			‖ Forbes, Donald Gordon, Shillingstone, Blandford

Date of Election.			
1874			Forbes, James, St. Kitts, Colebrook-road, Bexhill-on-Sea
1889	Trans.		Ford, John Simpson, c/o Messrs. W. Younger and Co., Abb Brewery, Edinburgh
1907			Foreman, Charles Thomas, Jamalpur, East Indian Railwa Bengal, India
1886			Formoy, James Arthur, Chestham, Grange-road, Sutton, Surre
1904			Forrest, John Kerr, 335, Spencer-street, Melbourne, Australia
1893			Forrester, Alexander Machattie, c/o Messrs. Laidlaw, MacK and Co., Ltd., 3400, Williamsburg-avenue, Richmon Va., U.S.A.
1909			Forrester, George Peters, 69, Beckstrasse, Darmstadt, German
1909			Forshaw, Arthur, M.Sc. (Manc.), 104, Holly-road, Handswort Staffs.
1910	Trans.		Forster, Aquila, B.Sc. (Dun.), Armstrong College of Scien Newcastle-on-Tyne
1905			Forster, Ernest Lyle Carman, M.A. (Toronto), 317, Queen-stre Ottawa, Canada
1892	Trans.	C. 1901-04. S. 1904-10 V.P. 1910-	‖Forster, Martin Onslow, D.Sc. (Lond.), Ph.D. (Würzburg), F.R. F.I.C., Royal College of Science, South Kensington, S.W. ; a 84, Cornwall-gardens, South Kensington, S.W.
1903			Forster, William, 30, Church-street, Seaham Harbour
1856	Trans.	C. 1865-8, 72-5, 85-6. V.P. 88-92.	‖Foster, George Carey, Prof., B.A. (Lond.), LL.D. (Glas.), D.S (Vict.), F.R.S., Emeritus Professor of Physics, Universi College, Gower-street, W.C. ; and Ladywalk, Rickmanswort Herts.
1872			Foster, Reginald Le Neve, Fulshaw Cottage, Wilmslow, Ma chester
1906			Foucar, James Louis, B.Sc. (Lond.), 15, Morden Roa Blackheath, S.E.
1900			Foulds, James, A.R.C.S., 21, Pearson-street, Darwen
1898			Foulerton, Alexander Grant Russell, F.R.C.S. (Eng.), L.R.C. (Lond.), D.P.H. (Cantab.), Haywards Heath, Sussex
1891	Trans.		‖Fowler, Gilbert John, D.Sc. (Vict.), F.I.C., Broad Oak, Urmsto Manchester
1900			Fowler, Morris Broad, 19, Westbury-road, Westbury-on-Try near Bristol
1882			‖Fowler, William, 78, Melton-terrace, New Hartley, Seat Delaval, Northumberland
1909			Fowler, William, c/o Messrs. Sanders, Rehders & Co., Ltd., 1 Fenchurch-street, E.C.
1907			Fowles, George, B.Sc. (Lond.), 28, Weltje-road, Hammersmit W.
1895			Fox, Albert Stanley, Greycote, Westcliff, Herne Bay, Kent

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ion.

Trans. Fox, John Jacob, B.Sc. (Lond.), 6, Alkham-road, Stamford Hill, N.

Fox, John Thomas, c/o Mrs. A. Pearce, 12, Church-hill, Iron Bridge, Salop.

Foxell, Edward William Lanchester, B.Sc. (Lond.), Barnes, Christ's Hospital, West Horsham, Sussex

Foy, Peter Bertram, 16, Burlington-road, Dublin

Francies, Joseph Valentine, Engineering College, Sibpur, Calcutta, India

Francis, Arthur Gordon, B.Sc. (Lond.), F.I.C., 50, Whitbread-road, Brockley, S.E.

Francis, Edward, Clifton-lane, Ruddington, Nottingham

Trans. Francis, Francis Ernest, Prof., D.Sc. (Vict.), Ph.D. (Erlangen), F.I.C., University College, Bristol

‖Francis, George Bult, 21, Taviton-street, Gordon-square, W.C.

Frankland, Henry, F.I.C., Streonshalh, The Crescent, Linthorpe, Middlesbro'.

Trans. {C. 1887-9 V.P. 1902-05.} ‖Frankland, Percy Faraday, Prof., Hon. LL.D. (St. Andrews), Ph.D. (Würzburg), Hon. M.Sc. (Birm.), B.Sc. (Lond.), A.R.S.M., F.R.S., F.I.C., The University, Edgbaston, Birmingham

‖Fraser, Angus, M.A. and LL.D. (Aberd.), M.D., C.M. (Aberd and Paris), 232, Union-street, Aberdeen

‖Fraser, James Christopher, Austin-street, Adelaide, S. Australia

Freear, Harry Marshall, Hardwick-road, Woburn Sands, Beds.

Freeman, Frederick William, Heatherdale, Spenser-road, Harpenden, Herts.

Freeman, Willie Ludford, M.A. (Oxon. and Dub.), LL.D. (Dub.), Borough of Hornsey Education Committee, 206, Stapleton Hall-road, Stroud Green, N.

Freestone, Joseph Thomas, Limehurst, Plymyard-avenue, Bromboro', Birkenhead

Freymuth, William Adolf, Rangoon, Burma, India

Trans. Friend, John Albert Newton, D.Sc. (Birm.), Ph.D. (Würzburg), Technical College, Darlington

‖Frost, Robert, B.Sc. (Lond. and Vict.), 55, Kensington-court, Kensington, W.

‖Fry, George, Carlin Brae, Berwick-on-Tweed

Trans. Frye, Colin Charlwood, 18, Woodfield-road, Ealing, W.

‖Fryer, Alfred Cooper, M.A. and Ph.D. (Leipzig), F.I.C., 13, Eaton-crescent, Clifton, Bristol

Fryer, Percival John, 27, Minster-road, Cricklewood, N.W.

Fürstenhagen, Otto, c/o Aktien-Gesellschaft für Anilinfabrikation, Berlin, S.O. 36, Germany

Date of Election.		
1891		Fulcher, Lionel William, B.Sc. (Lond.), Victoria and Alb Museum, S.W. ; and Ingleside, 37, Kempshott-road, Streath Common, S.W.
1896		Fuller, Charles James Pemeller, 603, Chorley-new-road, Horwi near Bolton, Lancs.
1909		Furneaux, George Pomeroy, B.A. (Oxon.), Tettenhall Colle Tettenhall, Wolverhampton
1909		Furnell, John Thomas, 32, Grosvenor-park-road, Walthamst N.E.
1894		‖Gabb, George Hugh, 83, Crayford-road, Tufnell-park, N.
1899		Gabriel, Edmund Vivian, M.A. (Cantab.), C.V.O., The Pi Southern-road, Southbourne, Christchurch
1901		Gadd, Henry Wippell, Barrister-at-Law, Common Room, Mid Temple, E.C. ; and 27, East Southernhey, Exeter
1901		Gajjar, Tribhuvandas Kalyandas, Prof., M.A. and B.Sc. (Bomb Gingaum, Bombay, India
1908		Gale, Robert Cecil, A.C.G.I., 13, Ellys-road, Coventry
1905		Gall, John Beaconsfield, A.C.G.I., F.I.C., 49, Glenlyon-ro Eltham Park, Kent
1903		Gandy, William Hunter, Bradley Court, Mitcheldean, Glouce
1908	Trans.	Ganguli, Atul Chandra, Prof., B.A. (Calcutta), Ravens College, Cuttack, Orissa, India
1883	Proc.	‖Garbutt, Llewellyn, M.A. (Cantab.), The College, Winchester
1909		‖Gardiner, Alexander David, 6, Wellfield-terrace, Springbu Glasgow
1903		Gardiner, Ernest Alexander, M.A. (Oxon.), The Colle Plymouth
1888		Gardiner, James Henry, 59, Wroughton-road, Balham, S.W.
1905		Gardner, Charles Richard, Chemical Laboratory, Gathurst, n Wigan
1906		Gardner, Edward, Bigwood-road, Meadway, Hendon, N.W.
1909	Trans.	‖Gardner, Henry Dent, M.Sc. (Manc.), 46, The Goffs, Eastbour
1901		Gardner, Hermann Charles Thomas, Miller Hospital and Ro Kent Dispensary, Greenwich-road, S.E.
1893	Trans.	Gardner, John Addyman, M.A. (Oxon.), F.I.C., Chemi Department, St. George's Hospital, S.W.
1888	Trans.	Gardner, Walter Myers, Prof., M.Sc. (Leeds), Technical Colle Bradford ; and 3, Fairmount, Manningham, Bradford
1910	Trans.	Garland, Charles Samuel, A.R.C.S., A.I.C., 18, Derwent-gro Dulwich, S.E.
1902		Garle, John Longsdon, F.I.C., 136, Holland-road, Kensington,
1893	Trans.	Garnett, Henry, 32, Dover-street, Manchester

e of ction.		
39	Trans.	Garrett, Frederic Charles, M.Sc. (Vict.), Armstrong College of Science, Newcastle-on-Tyne
98		Garside, Arthur Leonard Harry, Gledholt, Lower Broughton-road, Manchester
06		Garvey, Richard Godfrey Hamilton, c/o Commonwealth Oil Corporation, Ltd., Equitable-buildings, George-street, Sydney, N.S.W.
34		Gaskell, Joseph, 71, Haworth's-buildings, Cross-street, Manchester
00		Gasson, William, Dutoitspan-road, Kimberley, S. Africa
03		Gatehouse, Frank Brooks, 3, Lawrence-road, Romford
04	Trans.	Gawler, Robert, M.Sc. (Vict.), A.I.C., 3, South View-terrace, Bennett-road, Headingley, Leeds
37		Geisler, Joseph Frank, Mercantile Exchange Buildings, Hudson and Harrison-streets, New York City, U.S.A.
35		Gemmell, George Harrison, F.I.C., 4, Lindsay-place, Edinburgh
03		Gent, Percy William, Trentholme, Misterton, Gainsboro'
79		‖Gent, William Thomas, Misterton, Gainsboro'
96		George, George, F.I.C., Director of Technical Instruction, Auckland, New Zealand
39		‖Gerland, Conrad, M.Sc. (Vict.), Ph.D. (Marburg), Meadow Bank, Accrington
91		German, George, jun., Mansion House, Ashby-de-la-Zouch
95		‖Gerrans, Henry Tresawna, M.A. (Oxon.), 20, St. John-street, Oxford
75		Gerrard, Alfred William, Westward Ho, Wake-green-road, Birmingham
99		Getman, Frederick Hutton, Ph.D. (Johns Hopkins), Dalton Hall, Bryn Mawr College, Bryn Mawr, Penn., U.S.A.
88		Geyzel, John Lawrence van, Lieut.-Col. I.M.S., M.B. (Aberd.), F.I.C., Medical College, Madras, India
04		Ghose, Anu, 42, Shambazar-street, Calcutta, India
90		‖Gibbes, Cuthbert Chapman, M.D. and C.M., (Aberd.), M.R.C.P. (Lond.), D.P.H. (Cantab.), 89, Harley-street, W.
00		Gibbings, George William, Standard Bank of South Africa, Salisbury, Rhodesia, S. Africa
97		Gibbons, Joseph Lake, Secondary School, Blyth, Northumberland
07	Trans.	Gibson, Charles Stanley, M.A. (Oxon. and Cantab.), B.Sc. (Oxon.), M.Sc. (Manc.), Chemical Laboratory, The University, Cambridge
00		Gibson, John, 15, Tynedale-terrace, Hexham
92	Trans.	Gibson, John, Prof., Ph.D. (Heidelberg), F.R.S.E., F.I.C., Heriot-Watt College, Edinburgh
07		Gibson, William Howieson, B.Sc. (Lond.), 23, Wellington-road, Old Charlton, Kent

Date of Election.		
1888		Gibson, William Humphrey, 122, King's-road, Brighton
1895		Gilbard, John Francis Hutchins, F.I.C., 245, Dalston-lan Hackney, N.E.
1904		Gilchrist, James Gray, M.A. (Aberd.), B.Sc. (Lond.), Blythswoo Victoria-road, Annan, N.B.
1898		Gilderdale, Frederick, 32, Treherne-road, High West Jesmon Newcastle-on-Tyne
1883		‖Gill, E. Clarendon, 10, Barrack-road, Christchurch, Hants.
1888		Gill, John, Gwealhellis, Helston, Cornwall
1902		Gill, J. Arthur, Pennsylvania, Lower-green-road, Rusthall, Tu bridge Wells
1898	Proc.	Gilles, William Setten, A.C.G.I., F.I.C., The Cottage, Bockin Braintree, Essex
1908	Trans.	‖Gilling, Charles, B.Sc. (Lond.), A.I.C., 30, Carnarvon-roa Barnet, Herts.
1901		Gillman, Edward, Government Laboratory, Barbados, West Indi
1885		Girdwood, Gilbert Prout, M.D. and C.M. (McGill), M.R.C.S (Eng.), F.I.C., 111, University-street, Montreal, Canada
1897		Girtin, Thomas, M.A. (Cantab.), c/o H. L. Raphael's Refiner Thomas-street, Burdett-road, Limehouse, E.
1908	Proc.	Girvan, Arthur Frank, B.Sc. (Lond.), 117, Thurlow Par road, West Dulwich, S.E.
1898		Glaister, John, Prof., M.D. (Glas.), M.R.C.S. and L.R.C. (Edin.), 18, Woodside-place, Glasgow
1905		Glass, Archibald Melville, B.Sc. (Lond.), 37, Chancery-lane, W.
1907		Gledhill, Walter George, M.A. (Cantab.), The School Hous Woodbridge
1872		‖Glover, George Thomas, F.I.C., 24, Craven-hill-gardens, Lancast Gate, W.
1904		Glover, Harry James, Mount Pleasant, Wrattle-road, Westhar near Hastings
1906	Trans.	Glover, Walter Hamis, Ph.D. (Leipzig), 110, Coggeshall-roa Braintree
1907	Trans.	Godden, William, B.Sc. (Lond.), A.R.C.S., A.I.C., Station-roa east, Canterbury
1899		Golding, John, F.I.C., Midland Agricultural and Dairy Institut Kingston, Derby
1910		Goldsbrough, Harold Albert, A.I.C., Churchside, Herne Hill, S.
1878		‖Goldschmidt, S. A., Ph.D., c/o Columbia Chemical Works, 4 Sedgwick-street, Brooklyn, N.Y., U.S.A.
1889		Goldsmith, Byron B., Ph.B. (Columbia), 19, East 74th-stre New York City, U.S.A.
1898		Goldsmith, John Naish, B.Sc. (Vict.), Ph.D. (Heidelberg 67, Chancery-lane, W.C.

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99			Goltz, Harold Francis Carl, 63, Endymion-road, Brixton Hill, S.W.
97			Gomess, Alfred Francis Bilderbeck, M.R.C.S. (Eng.), L.R.C.P. (Lond.), 33, Drayton-gardens, South Kensington, S.W.
04			‖Goodson, John Augustus, F.I.C., Gordon College, Khartoum, Egypt
90			Goodwin, Thomas Small, Prof., M.B. and C.M. (Glas.), F.R.S.E., Derwent Lodge, London-road, Isleworth, Middlesex
96	Trans.		Goodwin, William, M.Sc. (Manc.), Ph.D. (Göttingen), South-Eastern Agricultural College, Wye, Kent
75			Gordon, Joseph Gordon, F.I.C., Queen Anne's-mansions, Westminster, S.W.
05			Gorman, Henry Isaac, 126, Quay, Waterford, Ireland
09	Trans.		Gortner, Ross Aiken, M.A. (Toronto), B.Sc. (Nebraska), Ph.D. (Columbia), Carnegie Institution, Station for Experimental Evolution, Cold Spring Harbour, Long Island, N.Y., U.S.A.
90			Gossling, Frank, B.Sc. (Lond.), H.M. Patent Office, Staple Inn, W.C.
89	Trans.		‖Gott, Benjamin Scaife, M.A. (Cantab.), The Guildhall, Westminster, S.W.
97	Trans.		Goulding, Ernest, D.Sc. (Lond.), F.I.C., 88, Sylvan-avenue, Chitts Hill, N.
87			Gover, Herbert James, 29, Piccadilly, Hanley, Staffs.
69			Gow, Robert John, Ivy Lea, Hough Green, near Widnes
93			Gower, Alfred Roland, Ashleigh, Furness-park-road, Barrow
71	Trans.	C. 1898-01, 1906-7	‖Gowland, William, Prof., A.R.S.M., F.R.S., F.I.C., 13, Russell-road, Kensington, W.
67	Trans.		Goyder, George Arthur, Hawkins-road, Medindie, Adelaide, S. Australia
80	Trans.		‖Graham, Christopher Colborne, F.I.C., Oriel House, Scarborough
90	Trans.		Grant, James, F.I.C., Oaklands, Gardner-road, Prestwich, near Manchester
87			Gravill, Edward Day, 42, Walmsley-street, Hull
2			‖Gray, George, Canterbury Agricultural College, Lincoln, New Zealand
90	Trans.		Gray, Robert Whytlaw, Ph.D. (Bonn), University College, Gower-street, W.C.
2	Trans.		‖Gray, Thomas, Prof., D.Sc. (Glas.), Ph.D. (Jena), The Technical College, Glasgow
5			Greaves, William Abraham, B.Sc. (Lond.), 23A, Broad-bank, Louth, Lincs.
5	Trans.	C 1894-5	‖Green, Arthur George, Prof., Hon. M.Sc. (Vict.), F.I.C., The University, Leeds; and 49, Cardigan-road, Headingley, Leeds

Date of Election.		
1902	Trans.	Green, Clarence James, B.Sc. (Vict.), c/o Messrs. Nicholson an Co., Beaumont Works, St. Albans
1905		Green, Ernest, 113, Hulton-street, Moss Side, Manchester
1908		Green, Henry Hamilton, 36, Princes-square, Regent-park Glasgow
1878		Green, Herbert, Hayle Mill, Maidstone
1887		Green, John Edward, A.R.S.M., F.I.C., West Clyne, Stretford Manchester
1909		Green, John Wilberforce, 22, Alwyne-road, Wimbledon, S.W.
1878		Green, Lawrence, Lower Tovil, Maidstone
1908		Green, Leonard Clifford, B.E. (Sydney), Wienholt-street Torwood, Brisbane, Queensland
1907		Green, William Heber, D.Sc. (Melbourne), The Universit Melbourne, Australia
1874	Trans.	‖Greenaway, Alfred John, F.I.C., The Orchard, Chertsey, Surre
1907		Greenough, Thomas Rigby, B.A. (Cantab.), A.I.C., Beechwoo Leigh, Lancs.
1885		Greenway, Thomas John, F.I.C., 369, Collins-street, Melbourn Australia
1894	Proc.	Greeves, Alfred, 25, Balmuir-gardens, Putney, S.W.
1891		Gregory, Alfred John, M.D. and B.S. (Dun.), M.D. (Cape Good Hope), M.R.C.S. and D.P.H. (Eng.), Department Public Health, Cape Town, S. Africa
1907		Gregory, Joshua Craven, B.Sc. (Lond.), F.I.C., 128, Wellingto street, Glasgow
1906	Trans.	Gregory, Thomas William Diggle, Kinross, Trentham, Stok on-Trent
1896		Grice, Walter Thomas, 9, Dalhousie-square, Calcutt India
1907		Grieb, Christopher Maurice Walter, B.Sc. (Lond.), F.I.C c/o Messrs. R. Fry & Co., Ltd., Middle-street, Brighton.
1910		Grieve, James, 127, Buchanan-street, Glasgow
1908		Griffin, John, B.A. (Cantab.), 7, Carlton-terrace, Batley
1888		‖Griffith, David Agnew, 87, Demesne-street, Seacombe, Birkenhea
1905		Griffiths, John, B.Sc. (Wales), The Grammar School, Lar Ireland
1902		Griffiths, John Thomas, 9, Greenhill-avenue, Tenby, S. Wales
1879		Griffiths, Thomas, The Cedars, Clapham Common, S.W.
1895		Grime, Herbert, 3, Hill-side, Lancaster
1902		Grimwade, Wilfrid Russell, B.Sc. (Melbourne), 342–346, Litt Flinders-street, Melbourne, Australia
1893		Grimwood, Robert George, F.I.C., 43, Leaside-avenue, Muswe Hill, N.

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06			Grindley, Harry Sands, Prof., D.Sc. (Harvard), B.Sc. (Illinois), State University, Urbana, Ill., U.S.A.
89			Gripper, Harold, Chapel-lane, Wilmslow, Cheshire
09			Grist, Charles James, Elgin House, Knockholt, Sevenoaks
00			Gritton, Henry Bertie, The Royal Mint, Sydney, N.S.W.
95			Grossmann, Edward Henry, 12, Alfred-place-west, South Kensington, S.W.
71	Trans.	C. 1877-8 1909- V.P. 1899-02	‖Groves, Charles Edward, F.R.S., F.I.C., Kennington Green, S.E.
05			Groves, Samuel Ernest, 2, Granville-gardens, Jesmond, Newcastle-on-Tyne
01			Groves, William Peer, B.A. (Cantab.), Green Bank, Plumbiey, Cheshire
06			Grubb, David Paton, B.Sc. (Edin.), A.R.S.M., 17, Victoria-road, Barnsley
97			Grundey, Frederick Roscoe, B.Sc. (Vict.), 33, Woodburn-square, Douglas, Isle of Man
03			Grundy, Frank Barnes, F.I.C., Red Lodge, King's-road, Richmond, Surrey
10			Guhlmann, Charles Frederick, Grantwood, Bergen Co., N.J., U.S.A.
02			Gumersall, Edward, 34, Freegrove-road, N.
95			Gunn, Alexander, 3, Clitheroe-road, Clapham, S.W.
02			Gunn, Gilbert, 181, Bury-new-road, Heywood, Lancs.
06			Gupta, Hem Chandra Dutt, Prof., M.A. (Calcutta), Tej Narayan Jubilee College, Bhagalpur, Bengal, India
98			Guthrie, Alexander, B.Sc. (Lond.), c/o Messrs. S. Courtauld & Co., Ltd., Bocking, Braintree
88	Trans.		Guthrie, Frederick Bickell, F.I.C., Chemical Laboratory, Department of Agriculture, Sydney, N.S.W.
04	Trans.		Guthrie, John Monteath, 199, Ferry-road, Leith, N.B.
04	Trans.		Guttmann, Leo Frank, Ph.D. (Heidelberg), A.C.G.I., F.I.C., School of Mining, Queen's University, Kingston, Ontario, Canada, and 18, Aberdare-gardens, N.W.
09			Gwyer, Alfred George Cooper, B.Sc. (Lond.), Ph.D. (Göttingen), Keate House, Dowas-park-west, Bristol
02	Trans.		Haas, Paul, D.Sc. (Lond.), Ph.D. (Freiburg), 11, Westbourne-park-road, W.
94			Hadley, Arthur, c/o Messrs. Georges Brewery, Ltd., Bristol.
93			‖Hadley, Henry Edwin, B.Sc. (Lond.), A.R.C.S., School of Science, Kidderminster

Date of Election.			
1886	Trans.		Haga, Tamemasa, Prof., D.Sc. (Japan), College of Science, Uni sity of Tokio, Japan
1881			Hailes, Alfred James de, F.I.C., 15, Red Lion-square, W.C.
1892			Haines, Walter Stanley, Prof., c/o Rush Medical College, Chic Ill., U.S.A.
1876	Trans.		Hake, Henry Wilson, Ph.D. (Giessen), F.I.C., Westmin Hospital Medical School, Caxton-street, S.W.
1893			Hale, Henry Ormsby, M.A. (Cantab.), Oundle School, Oundl
1891	Trans.	C. 1904–7	Hall, Alfred Daniel, M.A. (Oxon.), F.R.S., Lawes Agricult Trust, Rothamsted Experimental Station, Harpenden, He
1889			Hall, Allan Twistleton, c/o Messrs. Sissons Bros. and Co., L Hull
1891			Hall, Archibald, F.I.C., 7, Fenchurch-avenue, E.C.
1889	Trans.		Hall, John Albert, M.Sc. (Manc.), Victoria Chemical Wo Victoria, British Columbia
1903			Hall, John Thomas, West View, Stanwell, Staines
1907			Hall, Joseph Henry, B.Sc. (Lond.), 84, The Grove, Wa worth, S.W.
1906			Hall, Octavius, L.R.C.P. and L.R.C.S. (Edin.), L.F.P.S. (Gla D.P.H. (R.C.P.S.I.), 6, Devonshire-villas, Plymouth
1899			‖Hall, Samuel Godfrey, c/o Messrs. Edward Cook & Co., Wo Bow, E.
1908			Hall, William, B.Sc. (Vict.), Municipal Technical Sch The Newarke, Leicester.
1886			Halliburton, William Dobinson, Prof., M.D., B.Sc. and F.R.C (Lond.), M.R.C.S., (Eng.), F.R.S., Church Cottage, Marylebone-road, N.W.
1897			Halliwell, Edward, F.I.C., c/o Ribble Joint Committee, 2, Stan place, Preston
1902			Hallowell, Thomas Butterworth, Ladyshawe House, New Mi West Stockport
1900			Halstead, Reginald Gordon, 12 and 16, Coleman-street, E.C.
1890	Trans.		Hambly, Frederick John, F.I.C., c/o The Electric Reduction C Buckingham, Quebec, Canada
1888	Trans.		Hamilton, James Cullen, Barrows-green, near Kendal, Westmo land
1898			Hamilton, Oswald, Old Stratford, Stony Stratford, Bucks.
1897			Hamilton, Robert, 3, Westminster-terrace, Ibrox, Glasgow
1875	Trans.		Hamlet, William Mogford, F.I.C., Government Laborato Macquarie-street, Sydney, N.S.W.
1904			Hammond, Harold Sankey, Macdonald College, St. Anne Bellevue, Quebec, Canada
1901			Hammond, Herbert Blackmore, 99, Barton-road, Dover

Date of Election.			
1857			Hanbury, Cornelius, F.I.C., Plough-court, Lombard-street, E.C. and Manor House, Little Berkhamsted, Hertford
1900			Handcock, Walter Augustus, F.I.C., Pentlands, 39, The Avenue, Beckenham, Kent
1910			Handley, John, Box 124, Sudbury, Ontario, Canada
1895	Trans.		Hanes, Edgar Septimus, F.I.C., 34, Sarre-road, West Hampstead, N.W.
1910			Hanley, John, F.I.C., 74, Rowson-street, New Brighton, Cheshire
1902	Trans.		Hann, Archie Cecil Osborn, Rev., 54, Wood-vale, Forest Hill, S.E.
1872	Trans.		‖Hannay, James Ballantyne, F.I.C., Cove Castle, Loch Long, N.B. ; and The Rectory, Greenford, Southall
1889			‖Hanson, Alfred Miall, The Marjorie, Whalley, near Blackburn
1901	Trans.		Hanson, Edward Kenneth, M.A. (Cantab.), F.I.C., Woodthorpe, Royston-park-road, Hatch End, Middlesex
1906			Hanson, Harold Norman, Field Head, Brighouse, Yorks.
1895			Hanson, Weldon, Westwick, Ashville-avenue, Norton, Stockton-on-Tees
1897			Harbord, Frank William, A.R.S.M., F.I.C., Surbiton House, Englefield Green, Surrey
1859	Trans.	S.1865-73 V.P.73-6, 80-3, 92-5 P. 1895-7	‖Harcourt, Augustus George Vernon, M.A. (Oxon.), Hon. D.Sc. (Oxon.), Hon. D.C.L. (Dun.), Hon. LL.D. (Montreal), F.R.S., F.I.C., St. Clare, Ryde, Isle of Wight
1887	Trans.	C. 1902-05	‖Harden, Arthur, D.Sc. (Vict.), Ph.D. (Erlangen), F.R.S., F.I.C., 2, Marlborough-road, Richmond, Surrey
1901			Harding, Herbert, B.Sc. (Lond.), 47, Streathbourne-road, Upper Tooting, S.W.
1909	Trans.		Harding, Victor John, M.Sc. (Manc.), Lonsdale-terrace, Whitefield, Manchester
1892			Hardy, James Gordon, c/o The Creston Colorado Mining Co., Torres Sonora, Mexico
1909			Hargreaves, Egerton, M.Sc. (Manc.), Arthog, Garner's-lane, Davenport, Stockport
1876			Hargreaves, James, Peel House-lane, Farnworth, near Widnes, Lancs.
1884			Hargreaves, John, F.I.C., Widnes, Lancs.
1900			Hargreaves, William Arthur, M.A. and B.C.E. (Melbourne), F.I.C., Globe-chambers, Victoria-square-west, Adelaide, S. Australia
1900			Harker, George, D.Sc. (Lond.), 35, Boulevarde, Petersham, Sydney, N.S.W.
1909			Harland, Robert Main, 37, Lombard-street, E.C.
1878			‖Harland, William Dugdale, 48, King-street, Manchester

Date of Election.		
1897		‖Harley, Vaughan Berkeley, Prof., M.D. (Edin.), M.R C.P. (Lond.), 25, Harley-street, W.
1897		Harman, Harold Wallis, 90, Palace-road, Tulse Hill, S.W.
1903		Harmer, Francis Gerald, Cockburn High School, Leeds
1904		Harold, Frederick Clarkson-, 7, Bolton-road, Port Sunlight, Cheshire
1899		Harper, Henry Winston, M.D. (Virginia), The University of Texas, and 2208, San Antonio-street, Austin, Texas, U.S.A.
1907		Harrington, Arthur George, A.I.C., c/o Dr. Middleton, Municipal Buildings, Singapore, Straits Settlements
1881		Harrington, William Bury, Leeview, Montenotte, Cork
1906		Harris, Frederick James, 1, Alexandra-terrace, Bath-road, Exeter
1896		Harris, Frederick William, F.I.C., 26, John-street, Glasgow
1893		Harris, Harold, The Birmingham Metals and Munitions Co., Ltd., Ammunition Factory, Streetly, nr. Sutton Coldfield, Birmingham
1895		Harris, Harry, A.R.S.M., c/o The Tasmanian Smelting Co., Ltd., Zeehan, Tasmania
1894		Harris, Sydney Walters, Devon House, Walter-road, Swansea
1878		‖Harris, Thomas Frederick, B.Sc. (Lond.), Avondale, Thorpe St. Andrew, Norwich
1888		‖Harrison, Albert, Delamere, Grove-road, South Woodford, Essex
1894	Trans.	Harrison, Edward Frank, B.Sc. (Lond.), F.I.C., 55, Chancery-lane, W.C. ; and Langholm, Edgar-road, S. Croydon
1910		Harrison, Edwin, 18, Old Swan-lane, Upper Thames-street, E.C.
1901		Harrison, John Ansted, B.Sc. (Lond.), A.R.C.S., West Villa, Roydon-road, Diss
1888		Harrison, John Burchmore, C.M.G., M.A. (Cantab.), F.I.C., Government Laboratory, Georgetown, Demerara, British Guiana
1902		Harrison, Walter Ernest, 17, Soho-road, Handsworth, Birmingham
1901		Harry, Frederick Thomas, 106, Sandmere-road, Clapham Common, S.W.
1886		Hart, Bertram Harvey, Rosslyn, High-street, Sidcup, S.O., Kent
1900		Hart, Herbert William, 5, Cambridge-road, Ansdell, Lytham, Lancs.
1891		Hart, William Beamont, F.I.C., Laboratory, 8, Exchange-street, Manchester
1882		Hartley, Arthur, The Brewery, Emsworth, Hants.
1897	Trans.	Hartley, Ernald George Justinian, B.A. (Oxon.), The Bungalow, Foxcombe Hill, near Oxford
1899	Trans.	Hartley, Harold Brewer, M.A. (Oxon.), Balliol College, Oxford
1897		Hartley, Thomas, B.Sc. (Lond.), F.I.C., Swindon and North Wilts. Technical School, Swindon

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66	Trans.	C. 1877-80 V.P. 90-3	†Hartley, Walter Noel, Prof., Hon. D.Sc. (R.U.I.), F.R.S., F.I.C., Royal College of Science, St. Stephen's-green-east, and 10, Elgin-road, Dublin
90	Trans.		Hartog, Philip Joseph, M.A. (Manc.), B.Sc. (Lond. and Vict.), University of London, South Kensington, S.W.
00	Trans.		‖Hart-Smith, James, A.R.C.S., F.I.C., 4, Grafton-mansions, Venn-street, Clapham, S.W.
00	Trans.		Harvey, Alfred William, 13, Pendrell-road, St. Catherine's-park, Hatcham, S.E.
09			Harvey, Arthur John, 88a, East India Dock-road, Poplar, E.
85			Harvey, Ernest William, A.R.S.M., Stoneleigh, 23, Grove-road, Clapham Park, S.W.
81			Harvey, Sidney, F.I.C., Watling House, Canterbury
07			Harvey, Thomas Featherstone, 69, North-road, West Bridgford, Nottingham
94			Harvey, William Pellew, 62, London Wall, E.C.
94			Hatfield, John Adams, F.I.C., c/o Messrs. J. Lysaght, Ltd., Orb Iron Works, Newport, Mon.
92			Hatton, William Percy, c/o Messrs. W. R. Hatton and Sons, Ltd., Wormwood Scrubs, W.
80			Hawkes, Alfred Edward, M.D. (Brussels), L.R.C.P. (Edin.), 22, Abercromby-square, Liverpool
94	Trans.		Haworth, Edward, D.Sc. (Vict.), Sunnyside, Norman-road, Runcorn, Cheshire
98			Haworth, John, 117, Millhouses-lane, Sheffield
09	Trans.		Haworth, Walter Norman, M.Sc. (Manc.), Dacca House, Chorley
09			Haws, John Frederick, 34, Rock-lane-east, Rock Ferry, Birkenhead
05	Trans.		Hawthorne, John, Municipal Technical Institute, Belfast
07			Hay, William, Holton House, Beverley-road, Hull
10			Haycock, John, Hill Top House, Great Glen, Leicester
10	Trans.		Hayhurst, Walter, B.Sc. (Manc.), Tremellen-street, Accrington
05			Hayman, Jack Vernon Johnson, A.C.G.I., A.I.C., c/o Société Anonymé des Ciments, Massarah, Ligne de Helouan, Cairo, Egypt
00			Haynes, James Herbert, B.Sc. (Vict.), Sennen, 65, Kennington-avenue, Ashley Down, Bristol
909			Hayward, Eric, A.I.C., c/o W. R. Criper, Esq., Konnagar House, Konnagar, near Calcutta
906			Hayworth, William Prince, F.I.C., 47, Highfield-road, Dartford
903			Heasman, Harold Montague, 2, Broadway, Westminster, S.W.
891			Heath, John William, 1, Carlyle-square, Chelsea, S.W.
898			Heaton, John, Southcliffe, Roker, Sunderland

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† Longstaff Medallist, 1906.

Date of Election.			
1902			Heaton, Noël, B.Sc. (Lond.), Denmark House, Stonebridg Park, N.W.
1908			Hebron, John Henry Albert, B.Sc. (Lond.), Beechwalk, Littleover, Derby
1906	Trans.		Hedley, Edgar Percy, Ph.D. (Leipzig), A.R.C.S.I., 22, Francis road, Edgbaston, Birmingham
1899			Hedley, George Ward, M.A. (Oxon.), The College, Cheltenham
1905			Heely, Frederick William, 10, Yarborough-street, Grimsby
1876		C. 1895-9	Hehner, Otto, F.I.C., 11, Billiter-square, E.C.
1889			Helbing, H. B., 63, Queen Victoria-street, E.C.
1875			‖Hellon, Robert, Ph.D. (Heidelberg), A.R.S.M., F.I.C., Whinthwaite, Seascale, viâ Carnforth
1872			‖Helm, Henry James, I.S.O., F.I.C., Simonstone, 27, Hammelton road, Bromley, Kent
1899			Hembrough, James, A.R.C.S., A.I.C., Science, Art and Technical School, Market-street, Newton Abbott
1900			Hemingway, Frank Christian Richard, 133, Front-street, New York City, U.S.A.
1898	Trans.		Hemmy, Arthur Stanley, Prof., B.A. (Cantab.), M.Sc. (Melbourne), Government College, Lahore, India
1885	Trans.		‖Henderson, George Gerald, Prof., M.A., D.Sc. (Glas.), F.I.C., The Technical College, 204, George-street, Glasgow
1895	Trans		Henderson, James, Ph.D. (Münich), B.Sc. (St. Andrews), c/o Horlick's Malted Milk Co., Racine, Wisconsin, U.S.A.
1905			Henderson, James Alexander Russell, Prof., B.Sc. (Glas.), Chihli Provincial College, Paotingfu, N. China
1900	Trans.		Henderson, John Brownlie, F.I.C., Government Analyst, Brisbane, Queensland
1892			Hendrick, James, B.Sc. (Lond.), F.I.C., Marischal College, Aberdeen
1903			Hendrickson, Arthur V., The Gas Works, Lower Sydenham, S.E.
1909			Hendry, Robert Douglas, 16, Church-street, Alloa, N.B.
1901			‖Henley, The Hon. Francis Robert, M.A. (Oxon.), F.I.C., 9, Beaufort-gardens, S.W.
1905			Hennings, Carl Richard, Ph.D. (Freiburg), 19, St. Dunstan's-hill, E.C.
1899	Trans.		‖Henry, Thomas Anderson, D.Sc. (Lond.), 70, Doneraile-street, Fulham, S.W.
1905	Trans.		Henstock, Herbert, M.Sc. (Vict.), Ph.D. (Zürich), Wilcott House, Wilcott, near Nesscliffe, Shrewsbury
1904			Henzell, Archie Willoughby, Prof., Imperial Provincial College, Chinanfu, Shantung, China
1895			Heriot, Thomas Hawkins Percy, 37, Church-crescent, Muswell Hill, N.

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71			Herman, Douglas, F.I.C., Rainhill, Lancs.
76	Trans.	C. 1892-3	Heron, John, B.E. (R.U.I.), F.I.C., 110, Fenchurch-street, E.C.
08			Heron, John Maxwell, North House, Mistley, Essex
06			Herty, Charles Holmes, Prof., Ph.D. (Johns Hopkins), Ph.B. (Georgia), University of North Carolina, Chapel Hill, N.C., U.S.A.
05			Hetherington, Arthur Lonsdale, B.A. (Cantab.), Aingalay, Stormont-road, Highgate, N.
92	Trans.	C. 1903-05, 1908-	Hewitt, John Theodore, M.A. (Cantab.), D.Sc. (Lond.), Ph.D. (Heidelberg), F.R.S., Clifford House, Staines-road, Bedfont, Feltham, Middlesex
00			Hewitt, Samuel, 53, Dover-street, Unthank-road, Norwich
92			Hewlett, John Cooke, 35–42, Charlotte street, Great Eastern-street, E.C.
83	Trans.	C. 1897–1901	‖Heycock, Charles Thomas, M.A. (Cantab.), F.R.S., 3, St. Peter's-terrace, Cambridge
09	Trans.		Hibbert, Harold, M.Sc. (Vict.), Ph.D. (Leipzig), F.I.C., Experimental Station, E. I. du Pont de Nemenos Powder Co., Henry Clay P.O., Wilmington, Delaware, U.S.A.
76	Trans.		Hibbert, Walter, F.I.C., 144, Walm-lane, Willesden Green, N.W.
09			Hickinbotham, Reginald Vernon, 144, West-street, Maritzburg, Natal, S. Africa
81			‖Hiddingh, Michael, Newlands, near Capetown, S. Africa
05			Higgins, John Michael, 39, Queen-street, Melbourne, Australia
07			Higham, Richard, 133, Mauldeth-road, Withington, Manchester
09			Higson, Frank, Ivybank, Castle-street, Haulgh, Bolton
08	Trans.		Hilditch, Thomas Percy, B.Sc. (Lond.), A.I.C., 48, Pemberton-road, Harringay, N.
882			‖Hill, Alexander, 4, Broad-street place, E.C.
896	Trans.		Hill, Arthur Croft, M.A., M.D. and B.S. (Cantab.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), 169, Cromwell-road, S.W.
906	Trans.		Hill, Arthur Edwin, c/o A. A. Hill, Esq., Constantinople
896			‖Hill, Charles Alexander, B.Sc. (Lond.), F.I.C., 26, Courtfield-gardens, S.W.
896	Trans.		Hill, Ernest George, Prof., Sc.D. (Dub.), B.A. and B.Sc. (Oxon.), Muir College, Allahabad, India
905			Hill, William Basil, Eastfield, Stockton-lane, York
894			‖Hills, Edmond Herbert, Capt. R.E., 32, Prince's-gardens, S.W.
892			‖Hills, Harold Fletcher, Commercial Gas Works, Stepney, E.
906			Hills, James Stuart, F.I.C., Oxford Works, Tower Bridge-road, S.E.
898			Hills, Thomas Herbert, c/o The Almo Food Co., Ltd., Tile Kiln-lane, Upper Edmonton, N.

Date of Election.			
1873			‖Hills, Walter, 50, Wigmore-street, W.
1896			Hinchley, John William, A.R.S.M., 55, Redcliffe-road, S.W.
1908			Hinks, Edward, B.Sc. (Lond.), F.I.C., 16, Southwark-street, S.E
1900			Hinks, Percy John, A.R.C.S., F.I.C., Woodstock, Beaconsfiel road, Blackheath, S.E.
1894			Hirsch, Charles Theodore William, M.R.C.S. (Eng.), L.R.C. (Lond.), Charlinch, Rectory-road, Woolwich, S.E.
1870			Hislop, George Robertson, Gasworks, Blackstoun-road, Paisley
1898			‖Hislop, Lawrence, Gasworks, Uddingston, Glasgow
1898			Hislop, Robert Findlay, Greenhill House, Paisley
1883			‖Hobbs, Bedo, Lamb Brewery, Chiswick, W.
1905			Hobsbaum, Isaac Berkwood, c/o Messrs. Lockett, Bros. & Co. Iquique, Chili, S. America
1901			Hobson, Edwin, Howdendyke, Howden, Yorks.
1884			Hodges, Herbert John, Brewery House, York-building Southampton
1882	Trans.		‖Hodgkin, John, F.I.C., 97, Hamlet-gardens-mansion Ravenscourt Park, W.
1879	Trans.	C. 1883-5, 1907-10	Hodgkinson, William Richard Eaton, Prof., Ph.D. (Würzburg F.I.C., 89, Shooter's Hill-road, Blackheath, S.E.
1886			‖Hodgson, Christopher, 33, Oakdale-road, Netheredge, Sheffield
1873			‖Hodgson, Henry Tylston, M.A. (Cantab.), Harpenden, Herts.
1904			Hodgson, Thomas Reginald, M.A. (Cantab.), F.I.C., Count Offices, St. Mary's-gate, Derby
1885			Hogg, Edward Grindle, 1, Southwick-street, Hyde Park-square W.
1883			Hogg, W. Douglas, M.D. (Paris), 62, Champs Elysées, Paris
1904			Hoit, Alfred Henry, 4, Montgomerie-road, Southsea
1876			Holcroft, Harold, M.A. (Cantab.), Parkdale, Wolverhampton
1908			Holden, George Edward, 23, Durnford-street, Middleton, Manchester
1885			Holgate, Thomas, 5, Victoria-street, Westminster, S.W.
1908			Holland, Frank William Crossley-, 13, Balfour-road, Ilford, E.
1908			Holland, Norman, 4907, Sherbrooke-street-west, Montreal, Canad
1876			Holland, Philip, F.I.C., 22, Taviton-street, Gordon-square, W.C.
1902			Hollingworth, David Vincent, Gas Offices, Bloom-street, Salford
1905			Hollins, Cecil, 13, Clifton-road, Brockley, S.E.
1891			Holloman, Frederick Richard, Liston-street, Plaistow, E.
1886			Holloway, George Thomas, A.R.C.S., F.I.C., 9-13, Emmett-street, Limehouse, E.
1895			Holme, Arthur Edward, M.A. (Oxon.), The Wheelwright Grammar School, Dewsbury

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897	Trans.		Holmes, John, Government Laboratory, Clement's Inn Passage, W.C.
909			Holmyard, Eric John, 7, Manor-street, Cambridge
898	Trans.		Holroyd, George William Fraser, M.A. (Oxon.), The Chemical Works, Shoreham, Sussex
902	Trans.		‖Holt, Alfred, jun., B.A. (Cantab.), Crofton, Aigburth, Liverpool
893			Holthouse, Harold Bertram, 12, Melton-grove, West Bridgford, Nottingham
898			Homfray, David, B.Sc. (Lond.), F.I.C., The Ings, Misterton, near Gainsborough
878			Hooker, Ayerst Henham, F.I.C., Board of Health, Cairo, Egypt
892	Trans.		Hooker, Samuel Cox, Ph.D., 4422, Chestnut-street, Philadelphia, U.S.A.
883			‖Hooper, David, F.I.C., Economic and Art Section, Indian Museum, 1, Sudder-street, Calcutta, India
888		C. 1907-08	‖Hooper, Egbert Grant, F.I.C., 16, Royal-avenue, Sloane-square, S.W.
891			‖Hooper, Ernest Frederick, c/o Messrs. Brotherton & Co., Ltd., Wear Tar Works, South Dock, Sunderland
907	Proc.		Hooton, William Marrs, M.A. (Oxon.) M.Sc. (L'pool), F.I.C., Repton School, Repton, Burton-on-Trent
907			Hope, Geoffrey Dodleston, B.Sc. (Vict. and L'pool), Ph.D. (Halle), c/o Indian Tea Association, Calcutta, India
906			Hopkins, Frederick Gowland, M.A. (Cantab.), M.B., D.Sc., and L.R.C.P. (Lond.), M.R.C.S. (Eng.), F.R.S., F.I.C., 55, St. Andrew's-street, Cambridge
909			Hopkinson, Reginald, B.Sc. (Lond.), Cromwell Lodge, Huntingdon
904			Horn, George Mathieson, Capt., Ivylands, Epping, Essex
908			Hornby, Percy Hulme, 111, Nine Elms-lane, S.W.
894			‖Hornby, Richard, M.A. (Oxon.), Haileybury College, Hertford
908			Horrobin, Arthur, c/o Bombay, Baroda and Central India Railway Co., Ajmer, Rajputana, India
904			Horrod, George William Thomas, 7A, Lyric-road, Barnes, S.W.
897			Horseman, James Walter, Elstow School, Bedford
892			Horsfall, John, 4, Grange-avenue, Rawtenstall, Manchester
901	Proc.		Horton, Edward, B.Sc. (Lond.), 10, Smith-street, Chelsea, S.W.
909			Hoseason, James Henry, Alderside, Timperley, Altrincham
902			Hosking, Arthur Francis, c/o The Tasmania Gold Mining Co., Ltd., Beaconsfield, Tasmania
886			‖Hoskins, Arthur Percy, F.I.C., Clonlee, Rosetta-park, Belfast
909			Hough, Ralph, 367, Moss-lane-east, Manchester
871			Houlder, William Washington, North Hyde House, Southall
887	Proc.		Houlding, William, B.Sc. (Edin.), 34, Tynemouth-street, Liverpool

Date of Election.			
1882			||Howard, Alfred Gravely, Burnt House, Chigwell, Essex
1901			Howard, Bernard Farmborough, F.I.C., Quantocks, Woodford Green, Essex
1870		C. 1875-9, 83-5, 98-1902. V.P. 1886-9, 1903-06	||Howard, David, J.P., F.I.C., Devon House, Buckhurst Hill, Essex
1887	Trans.		||Howard, David Lloyd, Little Friday Hill, Chingford, Essex
1889			Howard, George William, Calverley, Tunbridge Wells
1875			Howard, Thomas, F.I.C., 50, Ellington-street, Liverpool-road, N.
1903			Howarth, John George, Danes Dyke, Chart-road, Reigate, Surrey
1882			Howe, James Lewis, Prof., M.D. (Louisville), Ph.D. (Göttingen), B.A. (Amherst), Washington and Lee University, Lexington, Va., U.S.A.
1880			Howell, Reginald, 95A, Southwark-street, S.E.
1905			Howgate, James Henry, B.A. (Lond.), The Grammar School, Huntingdon
1876			Howie, William Lamond, 26, Neville-court, Abbey-road, N.W.
1903			Howorth, Franklin Wise, 46, Lincoln's Inn-fields, W.C.
1889			||Hoyle, Richard Ashworth, Elm-grove, Fairlawn-road, Lytham, Lancs.
1889			Hoyles, Henry Richardson, 10, Fore-street, Wellington, Somerset
1907			Hoyten, William James, M.A., M.R.C.S. (Eng.), F.R.C.P. (Lond.), 37, Revelstoke-road, Wimbledon Park, S.W.
1907			||Hubbard, The Hon. Raymond Egerton, B.A. (Oxon.), c/o Messrs. Egerton, Hubbard & Co., St. Petersburg, Russia; and Addington Manor, Winslow, Bucks.
1910			Huck, John, M.A. (Cantab.), The Foundation, St. Bees School, St. Bees, Cumberland
1900			Hudson, Edmund Foster, M.A. (Cantab.), Churcher's College, Petersfield, Hants.
1878			Hudson, William, B.Sc. (Lond.), The Lilies, Twickenham
1899	Trans.		Hübner, Julius, M.Sc. (Manc.), F.I.C., Ash-villa, Cheadle Hulme, Cheshire
1903			Hughes, Edwin Reginald, 106, Queen Victoria-street, E.C.
1907			Hughes, Francis Townshend Cunynghame, Major, H.M.'s Assay Office, 47/1, Strand-road, Calcutta, India
1894	Trans.		Hughes, Frank, c/o Khedivial Agricultural Society, P.O. Box 63, Cairo, Egypt
1880	Trans.		Hughes, George Henry, 155, Fenchurch-street, E.C.
1910			Hughes, Herbert Hillier, B.Sc. (Lond.), The Grammar School, Tottenham, N.

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8		Hughes, John, F.I.C., Analytical Laboratory, 79, Mark-lane, E.C.
6		Hughes, John Gerard, 2, Canute-road, Southampton
8		Hughes, Joseph Albert, School of Mines, Charters Towers, Queensland, Australia
6		Hughes, Joshua Arthur, The Square, Abercarn, Mon.
5		Hughes, Theophilus Vaughan, A.R.S.M., F.I.C., 4, George-road, Edgbaston, Birmingham
2		Hughes, Thomas, F.I.C., Borough Analyst's Office, 31, Loudoun-square, Cardiff
8	Proc.	Hull, Thomas Ernest, 6, Selborne-terrace, Greenbank, Darlington
4		Hulme, John, Ph.D. (Halle), 5, Duke-street, Macclesfield
7	Trans.	Humphries, Herbert Brooke Perren, B.Sc. (Lond.), A.R.C.S., 117, Avenell-road, Highbury, N.
3		Humphrys, Norton Henry, Gas Engineer, Salisbury
9		Hunter, Archibald Glen Kidston-, c/o The Freemantle Wool Scouring Co., 13, Weld-chambers, Perth, W. Australia
3		Hunter, John, F.I.C., 37, Chambers-street, Edinburgh
5		Hunter, Matthew, M.A. (Oxon.), Rangoon College, Rangoon, Burma
8		Huntington, Alfred Kirby, Prof., A.R.S.M., F.I.C., Metallurgical Laboratory, King's College, Strand, W.C.
93	Trans.	Huntly, George Nevill, B.Sc. (Lond.), A.R.C.S., F.I.C., 14A, Finsbury-square, E.C.
02	Trans.	Hurtley, William Holdsworth, D.Sc. (Lond.), St. Bartholomew's Hospital, E.C.
61		Huskisson, Henry Owen, F.I.C., 74, Swinton-street, Grays Inn-road, W.C.
07		Hussey, Arthur Vivian, A.C.G.I., 21, Disraeli-road, Putney, S.W.
00		Hutchin, Henry William, Basset-road, Camborne, Cornwall
94		Hutchinson, Alfred, M.A. (Cantab.), B.Sc. (Lond.), 3, Windsor-road, Saltburn-by-the-Sea
90	Trans.	‖Hutchinson, Arthur, M.A. (Cantab.), Ph.D. (Würzburg), Pembroke College, Cambridge
84		‖Hutchinson, Christopher Clarke, F.I.C., 13, The Boltons, South Kensington, S.W.
08		Hutchinson, Henry Brougham, Ph.D. (Göttingen), Ashby Villa, Devonshire-road, Harpenden, Herts.
07		‖Hutchinson, William Doge, B.A. (Oxon.), Isabellastrasse 25 III, Munich, Germany
00		‖Ichioka, Tajiro, Prof., Minamihara, Hiratsuka, Japan
88		Idris, Thomas Howell Williams, M.P., 110, Pratt-street, Camden Town, N.W.

Date of Election.		
1907	Trans.	Ingham, Harry, M.Sc. (Vict.), 26, Hamilton-street, Bury, Lan
1889	Trans.	‖Ingle, Herbert, B.Sc. (Leeds), F.I.C., 18, Crown-terra Scarborough
1904	Trans.	Inglis, John Kenneth Harold, Prof., D.Sc. (Edin.), M.A., a B.Sc. (N.Z.), University College, Reading
1901		Ingram, Beresford, Department of Agriculture and Techni Instruction, 17, Ely-place, Dublin
1897	Trans.	Innes, William Ross, D.Sc. (Vict.), Ph.D. (Heidelberg), F.I. 6, Griffiths-road, Wimbledon, S.W.
1901		‖Ionides, Stephen Archigenes, Georgetown, Colo., U.S.A.
1908	Trans.	Irvine, James Colquhoun, Prof. D.Sc. (St. Andrews), Ph. (Leipzig), Chemical Laboratory, The University, and Edgecl St. Andrews
1906		‖Irving, Henry Carlyle, B.A. (Oxon.), 2, High-street, Chingfor N.E.
1883		‖Irwin, Wilfred, Inglehurst, Higher-lane, Stand, Manchester
1892		‖Isaac, John F. V., M.A. (Oxon.), 38, Silver-crescent, Gunne bury, N.
1885		Ivatt, Albert, M.A. (Cantab.), The Engadine, Histon, Ca bridge
1905		Jack, Maurice Brooks, Bedford Villa, 74, Park-avenue-sout Crouch End, N.
1894		Jackman, Edwin James, 60, Belgrave-road, Ilford, Essex
1883		‖Jackson, Alfred Henrick, Prof., B.Sc. (Vict.), M.Inst.E.E., T Electrical Engineering School, 349, Collins-street, Melbourn Australia
1894	Trans.	Jackson, David Hamilton, M.A. and B.Sc. (N.Z.), Ph.I (Heidelberg), 95, Abbey-road, N.W.
1882		Jackson, Edward, F.I.C., Raven's Clift, Oxford-road, Mosele Birmingham
1907		Jackson, Ernest Wilfrid, Godrevy, Saltburn-by-the-Sea
1900	Trans.	Jackson, Henry, M.A. (Cantab.), Downing College, Cambridge
1884	Trans.	Jackson, Herbert, Prof., F.I.C., Chemical Laboratory, King College, Strand, W.C.
1909		Jackson, Robert Ernest, York-villa, Shepherd's-lane, Dartford
1892		‖Jackson, Samuel, A.R.C.S., F.I.C., c/o N. Rhodes, Esq. Carnatic Mill, Perambore Barracks, N. Madras, India
1907		Jackson, Victor George, 21, Frankfurt-road, Herne Hill, S.E.
1902		Jackson, William Brannan, Kingston, Airdrie, N.B.
1903		Jackson, William Henry, 73, Church-street, West Hartlepool
1887		‖Jadhava, Khasberao B., M.R.A.C., Baroda, Bombay Presi dency, India

te of ction.			
00			Jaffé, Adolf, 8, Leyburn-grove, Shipley, Yorks.
78	Trans.		Jago, William, Barrister-at-Law, F.I.C., 3, Crown Office-row, Temple, E.C. ; and 17, Wilbury-avenue, Hove, Sussex
04	Trans.		James, Thomas Campbell, M.A. (Cantab.), B.Sc. (Wales), Edward Davies' Chemical Laboratories, University College of Wales, Aberystwyth
04			James, Walter Richmond, 20, Parkdale, Wolverhampton
01	Proc.		Jamieson, James Sprunt, F.I.C., Government Laboratory, Durban, Natal, S. Africa
79	Trans.	C.1882-5 F.S. 85-91 V.P.95-9	†‖Japp, Francis Robert, Prof., M.A. and Hon. LL.D. (St. Andrews), F.R.S., F.I.C., The University, Aberdeen
10			Jaques, Arthur, B.Sc. (Dun.), A.I.C., 23, St. Oswin's-avenue, Cullercoats, Whitley Bay, Northumberland
02			Jardin, David Smith, A.R.C.S.I., F.I.C., Rathgar House, Rathgar, Co. Dublin
02			Jardine, Douglas Kennedy, B.Sc. (Vict.), c/o Daily Chronicle Office, Georgetown, Demerara, British Guiana
82			Jarmay, Gustav, F.I.C., Hartford Lodge, Hartford, Cheshire
05			Jarrard, William John, B.Sc. (Lond.), A.R.C.S., The University, Sheffield
98			Jee, Edwin Charles, D.Sc. (Lond.), F.I.C., 39, Pepys-road, New Cross, S.E.
96	Proc.		Jeffers, Ernest Haynes, 87, Kyrle-road, West-side, Clapham Common, S.W.
09			Jeffery, John Hugh, 10, Daysbrook-road, Streatham Hill, S.W.
91	Trans.		Jenkins, Henry Charles, A.R.S.M., Assoc. M.Inst.C.E., Balmoral, Green-lane, Redruth, Cornwall
04			Jenkins, Herbert, 19, Bank-street, Braintree
92			‖Jenkins, John H. B., Chemical Laboratory, Great Eastern Railway Works, Stratford, E.
10			Jenkins, Leslie Charles Wood, 31, Eastcombe-avenue, Charlton, Kent
06	Trans.		Jenkinson, Ernest Arthur, 16, Granville-street, Skipton
94			Jenks, Robert Leonard, A.C.G.I., F.I.C., Central Excise Laboratory, Kasauli, Punjaub, India
94			Jennison, Francis Herbert, F.I.C., Chetwynds, Upper Cheyney, Bitton, Bristol
07			Jensen, Charles William Lamb, Lauriston, Grand-avenue, Southbourne, Bournemouth
97	Trans.		‖Jerdan, David Smiles, M.A. (Glas.), D.Sc. (Vict.), Ph.D. (Heidelberg), Temora, Colinton, Midlothian

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† Longstaff Medallist, 1891.

Date of Election.		
1898		Jessop, Samuel Morton, 19, Burton-street, Wakefield
1879		Jewson, Francis Albert Bowen, F.I.C., 24, York-road, Hove, Sussex
1901		Johnson, Charles Harold, M.D., C.M., F.R.C.S. and M.R.C.P. (Edin.), Beaumont, Northcote, Melbourne, Australia
1908		Johnson, Grove, Poste Restante, Post Office, Melbourne, Australia
1897	Trans.	Johnson, Harold, D.Sc. (Brussels), Box 275, Grimsby, Ontario, Canada
1883		Johnson, James Edward, F.I.C., 133, Earlham-grove, Forest Gate, E.
1904		Johnson, John Richard, 10, Copley-park, Streatham Common, S.W.
1897		Johnson, Otis Coe, Prof., 730, Thayer-street, Ann Arbor, Mich., U.S.A.
1906		Johnston, Archibald McArthur, Box 108, Germiston, Transvaal, S. Africa
1904		Johnston, John Haslam, M.Sc. (Vict.), F.I.C., Public Offices, Hampton, Middlesex
1896		Johnstone, James, F.I.C., Braehead, Parkhill, Rutherglen
1901	Trans.	Jollyman, Walter Henry, F.I.C., c/o F. W. Jollyman, Esq., Charlton-road, Keynsham, Bristol
1903		Jones, Alfred Owen, c/o Messrs. H. J. Packer & Co., Ltd., Greenbank, Bristol
1907		Jones, Benjamin Owen, Boksburg, Transvaal, S. Africa
1905	Trans.	Jones, Bernard Mouat, B.A. (Oxon.), Prof., Government College, Lahore, India
1898		Jones, Edward, B.Sc. (Lond.), F.I.C., 15, Macaulay-road, Clapham, S.W.
1906		Jones, Edward Rees, Llangedwyn Vicarage, Oswestry
1905		Jones, Edward Towyn, B.Sc., (Wales), A.I.C., 73, Risca-road, Newport, Mon.
1871	Trans.	Jones, Edward William Taylor, F.I.C., The Oaklands, and 10, Victoria-street, Wolverhampton
1873	Trans	Jones, Francis, M.Sc. (Manc.), F.R.S.E., Beaufort House, Alexandra-park, Manchester
1894		‖Jones, George Cecil, A.C.G.I., F.I.C., 43, Great Tower-street, E.C.
1893		Jones, Hedley Gordon, F.I.C., 32, Beechhill-road, Eltham, S.E.
1876	Trans.	‖Jones, Henry Chapman, F.I.C., Royal College of Science, South Kensington, S.W.
1909		Jones, Henry Humphrys, 18, Colquitt-street, Liverpool
1878		Jones, Henry Williams, Westbourne, Gravelly Hill, Birmingham

Date of Election.			
1900	Trans.		Jones, Humphrey Owen, M.A. (Cantab.), D.Sc. (Lond. and Wales), Clare College, Cambridge
1904			Jones, Horace Francis, Rose Bank, Cambridge-road, Uxbridge
1890			Jones, John Archyll, B.Sc. (Lond.), Reethville, Park-road, West Hartlepool
1901			Jones, John Lloyd Thomas, Lieut.-Col., I.M.S., M.B. (Dun.), M.R.C.S. (Eng.), D.P.H. (Cantab.), His Majesty's Assay Office, Calcutta, India
1892	Trans.		Jones, Lionel Manfred, B.Sc. (Lond.), Municipal Technical School, Suffolk-street, Birmingham
1906			Jones, Llewelyn Thomas, B.Sc. (Wales), 22, Ashfield-terrace, Bingley, Yorks.
1891			Jones, Moses William, The Cottage, Brislington, Bristol
1901			Jones, Robert Henry, M.Sc. (Vict.), The Harris Institute, Preston
1898			Jones, Thomas Hill-, Invicta Mills, Bow-common-lane, E.
1904			Jones, William App., A.M. (North Carolina), Ph.D. (Baltimore), c/o The Boston Artificial Leather Co., Metropolitan Building, New York City, U.S.A.
1910	Trans.		Jones, William Jacob, B.Sc. (Wales), Queen's-terrace, Llanrwst, Denbighshire
1904	Trans.		Joseph, Alfred Francis, Prof., B.Sc. (Lond.), A.R.C.S., Ceylon Technical College, Colombo, Ceylon
1893	Trans.	C. 1906-09	Jowett, Hooper Albert Dickinson, D.Sc. (Lond.), 5, Miskin-road, Dartford, Kent
1900			Joyce, Thomas Goode, B.Sc. (Lond.), F.I.C., Lyttleton Preserve and Drysaltery Works, Bromford-lane, West Bromwich
1893			Káká, Sorabji Manekji, Devon Villa, Karachi, Sind, India
1886	Trans.		Kawakita, Michitada, Engineering College, Tokio, Japan
1905	Trans.		Kay, Sydney Alexander, D.Sc. (St. Andrews), Chemistry Department, The University, Edinburgh
1881	Trans.		‖Kay, William Edward, 349, The Cliff, Broughton, Manchester
1889			Kaye, James Robert, M.B. and C.M. (Glas.), D.P.H. (Cantab.), Medical Officer of Health, West Riding of Yorkshire, Wakefield
1907	Trans.		Kaye, John, M.A. and B.Sc. (Glas.), North Britain Glass Works, Perth, N.B.
1886	Trans.	C. 1903-5	‖Keane, Charles Alexander, D.Sc. (Vict.), Ph.D. (Erlangen), F.I.C., The Sir John Cass Technical Institute, Jewry-street, Aldgate, E.C.
1909			Keeble, Horace, Wereham Hall, Stoke Ferry, Norfolk
1882			‖Keen, Austin, Hon. M.A. (Cantab.), Cefn Llys, Bentley-road, Cambridge

Date of Election.			
1908			Keiller, Patrick Anderson, B.Sc. (St. Andrews), c/o Colombo Commercial Co., Ltd., Colombo, Ceylon
1894			‖Kellas, Alexander Mitchell, B.Sc. (Lond.), 2, St. Mark's-square, Regent's Park, N.W.; and Chemical Dept., Middlesex Hospital Medical School, W.C.
1874			Kellner, William, Ph.D. (Göttingen), F.I.C., 135, Victoria-road, Old Charlton, S.O., Kent
1867			‖Kemp, David Skinner, 52, Coverdale-road, Shepherd's Bush, W.
1882			‖Kemp, William Joel, F.I.C., Caerthillian, Sidcup, S.O., Kent
1903			Kemp-Welch, Maurice, B.A. (Cantab.), Parkstone, Weybridge, Surrey
1884			Kendall, George Frederic, B.A. (Cantab.), The Hollies, Stratford-on-Avon
1874			Kendall, James Alfred, F.I.C., Lonesome Chemical Works, Streatham Common, S.W.
1910	Trans.		Kenner, James, Ph.D. (Heidelberg), B.Sc. (Lond.), The University, Sheffield
1896			‖Kennicott, Cass Langdon, Chicago Heights, Illinois, U.S.A.
1903			Kent, Thomas Oliver, Handforth Laboratories, Handforth-road, Kennington, S.E.
1889			Kenwood, Henry Richard, M.B. and C.M. (Edin.), L.R.C.P. (Lond.), 126, Queen's-road, Finsbury Park, N.
1908	Trans.		Kenyon, Joseph, B.Sc. (Lond.), A.I.C., 25, Irving-place, Blackburn
1903			Kerr, James Stewart, A.R.C.S., F.I.C., 19, Reservoir-road, Edgbaston, Birmingham
1883			Kerry, William Hugh Rubens, The Sycamores, Windermere
1900			Kershaw, James Henry, Corporation Sewage Works, Dalton, Rotherham, Yorks.
1901			Kettle, James David, B.Sc. (Lond.), F.I.C., 3, Huguenot Mansions, East-hill, Wandsworth, S.W.
1902			Kewley, James, M.A. (Cantab.), c/o De Bataafsche Petroleum Maatschappij, Balik Papan, Dutch Borneo
1905			Killby, Leonard Gibbes, B.A. and B.Sc. (Oxon.), 20, Portland-court, Great Portland-street, W.
1900			Kilner, George Washington, M.A. (Lond.), Ormefield, Long-lane, Church-end, Finchley, N.
1884			Kilpatrick, William Stirling, Hawklin, Stuart-drive, Colston, near Bishopbriggs
1903			Kin, Thein, B.A. (Calcutta), Chemical Examiner's Office, Rangoon, Lower Burma, India
1872	Trans.	C. 1887-92	‖Kinch, Edward, Prof., F.I.C., Royal Agricultural College, Cirencester

Date of Election.			
1907			King, Albert Theodore, B.Sc. (Lond.), F.I.C., Chemical Department, The University, Leeds; and Church-hill, Horsell, Woking, Surrey
1881	Trans.		King, Alfred John, Rock Bank, Bollington, near Macclesfield
1902			‖King, Frank Eustace, B.Sc. (Lond.), F.I.C., 75, Gracechurch-street, E.C.
1903			King, Frank William George, 15, Almond-road, Tottenham, N.
1897			King, Herbert, M.Sc. (Vict.), F.I.C., 8, Avenue-road, Scarborough
1908			King, James Kirkman, B.A. (Cantab.), Downside College, Stratton-on-the-Fosse, Bath
1876			King, John Falconer, F.I.C., 30, Chambers-street, Edinburgh
1902			King, Sidney Isaac, Hazeldene, Avenue-road, Bexley Heath, Kent
1895			Kingdon, George Holman, M.A. (Oxon.), c/o Messrs. Crosfield, Limited, Warrington; and Ivy Lodge, Froghall, Warrington
1872	Trans.		‖Kingzett, Charles Thomas, F.I.C., Newlands, St. George's-avenue, Weybridge, Surrey
1895			‖Kinnicutt, Leonard Parker, Prof., Sc.D. (Harvard), Worcester Polytechnic Institute, Worcester, Mass., U.S.A.
1891	Trans.	C. 1894-6- V.P. 1908-	†‖Kipping, Frederic Stanley, Prof., D.Sc. (Lond.), Ph.D. (Munich), F.R.S., F.I.C., University College, Nottingham
1886			Kirby, Herbert Edward, 41, Gordon-square, W.C.
1909			Kirby, Oswald Farquhar, M.A., and B.Sc. (Aberd.), The Leeds Institute, Leeds
1895			‖Kirkaldy, Prof. Patrick Henry, F.I.C., Chemical Department, King's College, W.C.
1903			Kirkby, William, M.Sc. (Manc.), Winster House, Thornfield-road, Heaton Moor, Stockport
1889			Kitchin, John, The Middlesex Hospital, W.C.
1888			‖Knaggs, Alfred Battye, 37, Mannville-terrace, Bradford
1889			Knight, Frederick Charles, c/o The Spassky Copper Mine, Ltd., Spassky, near Akmolinsk, South Western Siberia
1903			Knight, Harley Fancut, Ledbury, 64, Amhurst-park, Stamford Hill, N.
1894			Knight, James, M.A. and D.Sc. (Glas.), St. James's Public School, Calton, Glasgow
1896			Knight, John Burnett, Bushwood, Wanstead, Essex
1894			Knight, William Albert, Sexey's Trade School, Bruton, Somerset
1878			Knights, James West, F.I.C., County Laboratory, Cambridge
1879			Knowles, Joshua, Stormer-hill, Tottington, Bury
1864			Knox, George Walter, B.Sc. (Lond.), 16, Finsbury-circus, E.C.
1873			Koch, Walter Edward, M.A. (Cantab.), P.O. Box 718, El Paso Texas, U.S.A.

† Longstaff Medallist, 1909.

Date of Election.			
1887	Trans.		Koga, Yoshimasa, The Imperial Mint, Osaka, Japan
1904			Komppa, Gustav, Prof., Ph.D. (Helsingfors), Polytechnik, Helsingfors, Finland
1885			Koningh, Leonard de, F.I.C., 4, St. Martin's-road, Stockwell, S.W.
1910			Krall, Hans, B.A. (Dub.) Trinity College, Dublin
1892			Krause, Georg, Prof. Dr., Cöthen (Anhalt), Germany
1908	Proc.		Krishnayya, H. V., B.A. (Madras), Government Chemica Laboratory, Mallesvaram, Bangalore, Mysore
1910			Kwoh, Sea-Kwain, 125, Acomb-street, Manchester
1859	Trans.		Kynaston, Josiah Wyckliffe, F.I.C., Chemical Laboratory, 3 Oak-terrace, Beech-street, Liverpool
1900			Kynaston, William Charles Robert, 9, Harland-road, Highe Tranmere, Birkenhead
1906			Ladell, William Richard Simpson, A.I.C., Cedara, Natal, S. Afric
1909			Lakhani, Hassum Alidina, M.D. (Brussels), Murud Janjira, Bombay Presidency, India
1893			Lamb, Edmund George, M.A. (Oxon.), M.P., Borden Wood Liphook, Hants.
1900			Lamb, Morris Charles, The Leathersellers Technical College 176, Tower Bridge-road, S.E.
1910			Lamb, Samuel, A.R.S.M., May Villa, Birmingham-road, Wes Bromwich
1892	Trans.		‖Lamb, Thornton Charles, Ph.D. (Heidelberg), c/o Messrs Brunner, Mond and Co., Crescent Wharf, Silvertown, E.
1893			Lambert, Wesley J., Chemical Laboratory, Royal Gun Factory Woolwich, S.E.
1903	Proc.		Lamplough, Francis Edward Everard, B.A. (Cantab.), Trinit College, Cambridge
1877			Lancaster, William James, F.R.C.S., Pine Crest, Barnt Green Worcs.
1902			Landau, A. Lionel, 20, Highbury-new-park, N.
1900	Trans.		Lander, George Druce, D.Sc. (Lond. and St. Andrews), F.I.C. Royal Veterinary College, Camden Town, N.W.
1897	Trans.		Lang, William Robert, Prof., D.Sc. (Glas.), F.I.C., Th University, Toronto, Canada
1899			Lange, Ernest Frederick Stephen, Fairholm, Willow Bank Fallowfield, Manchester
1885			Langer, Charles, Ph.D. (Zürich), Ynyspenllwch, Clydach S.O., Glamorgan
1891			‖Langham, Edgar Norman, Rev., M.A. (Cantab.), Rastric Grammar School, Brighouse
1894	Trans.	C. 1904-7	Lapworth, Arthur, D.Sc. (Lond.), F.R.S., F.I.C., The University Manchester

Date of Election.		
1908		Larmuth, Lionel Gordon, Grove House, Cheadle Hulme, Manchester
1901	Proc.	Larter, Alfred Tabois, B.Sc. (Lond.), 86, Inderwick-road, Stroud Green, N.
1883		Lascelles, Brian Piers, M.A. (Oxon.), Headland, Mount-park, Harrow-on-the-Hill
1901	Trans.	Lattey, Robert Tabor, Trinity College, Oxford
1906		Lattey, William Tabor, Tarmon, Streatham Park, S.W.
1891	Trans.	Lauder, Alexander, D.Sc. (Edin.), Edinburgh and East of Scotland College of Agriculture, 13, George-square, Edinburgh
1886	Trans.	Laurie, Arthur Pillans, Principal, M.A. (Cantab.), D.Sc. (Edin.), F.R.S.E., The Heriot-Watt College, Edinburgh
1910		Lavender, John Herbert, 27, Parade-street, Barrow-in-Furness
1876		‖Law, Channell, Ilsham Dene, Torquay
1905	Trans.	Law, Herbert Drake, B.Sc. (Lond.), Borough Polytechnic, 103, Borough-road, S.E.
1896		‖Law, Herbert Edward, 636, Pine-street, San Francisco, Cal., U.S.A.
1890	Trans.	‖Law, Robert, F.I.C., The Royal Mint, Melbourne, Australia
1903		Lawrence, Henry William, Johnsonville, Wellington, New Zealand
1900		Laws, Arthur Robert, B.Sc., (Lond.), 90, St. George's-terrace, Newcastle-on-Tyne
1882		Laws, Joseph Parry, F.I.C., Laurel Bank, Claremont-road, Headingley, Leeds
1890	Trans.	‖Laycock, William Frederick, Ph.D., 7, Park-street, Dewsbury
1890		Lea, Arthur Sheridan, M.A. and Sc.D. (Cantab.), F.R.S., Sunnyside, Sidcup, S.O., Kent
1886		‖Leach, Walter, 21, St. Andrew's-place, Bradford
1902		Leader, George Herbert, Montego Bay Secondary School, Montego Bay, Jamaica
1894	Trans.	‖Lean, Bevan, B.A. and D.Sc. (Lond.), Sidcot School, Winscombe, Somerset
1888		Lease, Frank Edward, Sapong Estate, Fort Birch, British North Borneo
1902		Leather, John Petty, Whittier, Colne-road, Burnley, Lancs.
1891	Trans.	Leather, John Walter, Ph.D. (Freiburg), F.I.C., Agricultural Research Institute, Pusa, Bengal, India
1900		‖Leathes, John Beresford, Prof., M.A., M.B. and B.Ch. (Oxon.), F.R.C.S. (Eng.), The University, Toronto, Canada
1889		Ledingham, Laurence Napier, Govandale, Taptonville-crescent, Sheffield
1883		Lee, Herbert Cabry, Thames Ditton Brewery, Thames Ditton, Surrey

Date of Election.			
1898			Lee, Harry Lancelot, 8, Station-avenue, New Earswick, York
1897	Trans.		Lee, Theophilus Henry, 36, Rua do Ouvidor, Rio de Janeiro, Brazil
1909			Leech, Benjamin, M.A. (Cantab.), Beech Knoll, Macclesfield
1909			Leedham, Joseph, 176, Bromford-lane, West Bromwich
1905			Leek, William Henry, B.A. (Lond.), Elm View, Leigh, Lancs.
1899			Leeming, William Thomas, M.Sc. (Vict.), The Hollins, Hanover-road, Canterbury
1903	Trans.		Lees, Frederic Herbert, 31, Summerhill-road, Dartford, Kent
1891			Leffler, Rudolf, 75, Harcourt-road, Sheffield
1889			‖Legg, John Edmund, M.A. (Cantab.), F.I.C., Cae Rhys, Dorchester-road, Weymouth
1901			Lehmann, Adolf Ludwig Ferdinand, B.Sc. (Toronto), Ph.D. (Leipzig), University of Alberta, Strathcona, Alberta, Canada
1903			Leigh, Arthur Graham, jun., Chorcliff House, Chorley, Lancs.
1889			Leigh, Cecil, F.I.C., Birmingham Metal and Munitions Co., Ltd., Adderley Park Rolling Mills, Birmingham
1904			Le May, Percy Kent, 6, Lothair-villas, Hatfield, Herts.
1891			Lennox, Robert N., Morvah, Hartington-road, Chiswick, S.W.
1899			Leon, Arthur Alexander, Ray House, Ray-park-road, Maidenhead
1906	Trans.		Le Rossignol, Robert, B.Sc. (Lond.), A.I.C., 2, Caesarea-place, Jersey, Channel Islands
1904			Lessing, Rudolf, Ph.D. (Munich), Southampton House, 317, High Holborn, W.C.
1902			Lessner, Charles B., Carril, Spain
1895	Trans.	C. 1907-	‖Le Sueur, Henry Rondel, D.Sc. (Lond.), F.I.C., St. Thomas's Hospital, S.E.
1899			Lett, Stephen Joshua, Panjaboengan, via Padang, Sumatra (West Coast), Dutch East Indies
1879			Letts, Edmund Albert, Prof., Hon. D.Sc. (R.U.I.), Ph.D. (Göttingen), F.I.C., Queen's College, Belfast
1903			Levy, Henry Wolff, 423B, Little Collins-street, Melbourne, Australia
1909	Trans.		Levy, Leonard Angelo, B.A. (Cantab.), B.Sc. (Lond.), 60, Priory-road, West Hampstead, N.W.
1888	Trans.		Lewes, Vivian Byam, Prof., F.I.C., 30, Croom's-hill, Greenwich, S.E.
1907			Lewis, Carl, Lewis'-buildings, President-street, Germiston, Transvaal, S. Africa
1899	Trans.		Lewis, Edward Watkin, Hollycroft, Loughton, Essex
1901			Lewis, Ernest Alfred, 310, Dudley-road, Birmingham
1910			Lewis, Frederick Charles, School of Pathology, Yates Laboratories, The University, Liverpool.

Date of Election.			
1909	Proc.		Lewis, William Cudmore McCullagh, M.A. (R.U.I), D.Sc. (L'pool), University College, Gower-street, W.C.
1894	Trans.		Lewis, William Henry, M.A. (Oxon.), F.I.C., 27, St. Leonard's-road, Exeter
1869	Trans.		‖Lewis, William James, Prof., M.A. (Oxon. and Cantab.), F.R.S., New Museums, Cambridge
1888	Trans.	C. 1902-03	‖Lewkowitsch, Julius, M.A. and Ph.D. (Breslau), F.I.C., 71, Priory-road, West Hampstead, N.W.
1878			‖Lichtenstein, Theodore David, F.I.C., Chemical Works, Silvertown, E.
1896			Lidgey, Cecil Rudolf, 50a, Forest Hill-road, East Dulwich, S.E.
1900			Liebmann, Adolf, M.A. and Ph.D. (Bonn), 16, Darley-avenue, West Didsbury, Manchester
1908			Linch, Frank William, A.I.C., 9, Gladstone-avenue, Manor Park, E.
1903			Linday, John Howard, c/o The Nivalbo Co., Mapperley, Nottingham
1901			Linde, Harold Theodor Granville van der, c/o Continental Rubber Co., 111, Broadway, New York City, U.S.A.
1908			Lindley, Arthur Stanley, Laboratory, Prince-building, Medows-street, Bombay, India
1899			Lindsey, Robert William, 14, Hilldrop-road, Camden-road, N.
1886	Trans.		Ling, Arthur Robert, F.I.C., 74, Great Tower-street, E.C.
1899			Linstead, Edward Flatman, 15, Station-avenue, Winchmore Hill, N.
1902			Liotard, Ernest, 2, Rue de France, Nice, France
1905			Lister, Joseph, B.Sc. (Lond.), Ph.D. (Leipzig), A.R.C.S., Bella Vista, Mellor-road, Ashton-under-Lyne
1853	Trans.	V.P. 1883-7, 1898-1901.	‖Liveing, George Downing, Emeritus Prof., M.A. (Cantab.), Hon. Sc.D. (Cantab. & Dub.), F.R.S., F.I.C., The Pightle, Cambridge
1872	Trans.	V.P. 1910-	‖Liversídge, Archibald, Emeritus Prof. M.A. (Cantab.), Hon. LL.D. (Glas.), A.R.S.M., F.R.S., F.I.C., Hornton Cottage, Hornton-street, Kensington, W.
1903			Livesey, Charles Edwin Leonard, B.Sc. (Vict.), Stonyhurst College, Blackburn, Lancs.
1883			Livingston, William John, F.I.C., 26, Osbaldeston-road, Stoke Newington Common, N.
1909			Livsey, Harry, 26, Thorpe-street, Old Trafford, Manchester
1880			‖Lloyd, Alfred, The Dome, Bognor, Sussex
1876	Trans.		Lloyd, Frederick James, F.I.C., Muscovy House, 6, Trinity-square, E.C.
1905			Lloyd, George Moss, M.A. (Vict.), M.Sc. (L'pool), The Limes, 7, Pepys-road, Raynes Park, S.W.
1907			Lloyd, Percival George, Kelvinside, Lower Ham-road, Kingston-on-Thames

Date of Election.		
1896		Lloyd, Thomas Henry, c/o Messrs. Quibell Bros., Ltd., Newark on-Trent
1900		Lockhart, Thomas Lamb, Glencairn Main Reef Gold Mining Co. Ltd., P.O. Box 191, Germiston, Transvaal, S. Africa
1902		Logan, Thomas Stratford, The Colony, Ewell, Surrey
1884		London, John Edward, M.D. (Dun.), M.R.C.S. (Eng.), L.R.C.P (Lond.), 62, Main-street, Georgetown, Demerara, W. Indies
1910		‖Long, Frank Stevenson, B.Sc. (Lond.), 80, Tylney-road, Fores Gate, E.
1910		Longman, Charles Herbert Bell, A.R.C.S., Tientsin Anglo Chinese College, Tientsin, N. China
1872		‖Longstaff, George Blundell, M.A. and M.D. (Oxon.), F.R.C.P. (Lond.), M.R.C.S. (Eng.), Highlands, Putney Heath, S.W.
1904		Longstaff, James Patrick, D.Sc. (Edin.), 17, Fettes-row, Edinburgh
1873		‖Loram, Herbert Yabsley, F.I.C., 49, Buxton-road, Chingford, Essex
1878	Trans.	‖Louis, David Alexander, F.I.C., 123, Pall Mall, S.W.
1882		Love, Edward Gurley, Ph.D. (Columbia), 80, East 55th-street, New York City, U.S.A.
1882		‖Lovibond, Thomas Watson, F.I.C., West Jesmond House, Newcastle-on-Tyne
1884		‖Low, Charles William, M.B. (Dun.), M.R.C.S. (Eng.), L.R.C.P. and D.P.H. (Lond.), Stricklands, Stowmarket, Suffolk
1904	Trans.	Lowe, Frank Harold, M.Sc. (Vict.), South-Western Polytechnic, Manresa-road, Chelsea, S.W.
1878		‖Lowe, Walter Bezant, M.A. (Cantab.), Cae Carw, Llanfairfechan, Carnarvonshire
1876		Lowe, William Foulkes, A.R.S.M., F.I.C., 9, Hough-green, Chester
1898	Trans.	‖Lowry, Thomas Martin, D.Sc. (Lond.), 130, Horseferry-road, Westminster, S.W.
1901		Lowson, William, B.Sc. (Lond. and Leeds), F.I.C., The University, Leeds
1899		Lucas, Alfred, F.I.C., Survey Department, Finance Ministry, Giza, Egypt
1905		Lucas, Edward William, F.I.C., Oxford Works, Tower Bridge-road, S.E.
1902		Lucas, Harry, The South of England College of Pharmacy, 186, Clapham-road, S.W.
1905		Luck, Alfred Courtenay, Laboratorio de Polvoras, Ministerio de Marina, Darsena Norte, Buenos Ayres, Argentine, S. America
1910		Lucking, Hubert Leslie, Ph.D. (Heidelberg), Morningside, Child's Hill, N.W.
1902	Trans.	Ludlam, Ernest Bowman, D.Sc. (L'pool), M.Sc. (Vict.), College-gate, College-road, Clifton, Bristol

Date of Election.		
1891		Ludlow, Lionel, Standard Bank of South Africa, Bulawayo, Rhodesia, S. Africa ; and Southville, Swansea
1877	Trans.	‖Luff, Arthur Pearson, M.D., B.Sc., F.R.C.P. and L.S.A. (Lond.), M.R.C.S. (Eng.), D.P.H. (Glas.), F.I.C., 9, Queen Anne-street, Cavendish-square, W.
1890	Trans.	Lumsden, John Scott, D.Sc. (St. Andrews), Ph.D. (Munich), 9, Rosewood-terrace, West Park, Dundee
1907		Lunan, George, 50, Garscube-terrace, Murrayfield, Edinburgh
1909		Lundholm, Carl Olof, F.I.C., 2, Eton-avenue, Hampstead, N.W.
1872	Trans.	‖Lupton, Sydney, 102, Park-street, Grosvenor-square, W.
1893	Trans.	Luxmoore, Charles Mann, D.Sc. (Lond.), F.I.C., Central Technical Schools for Cornwall, and 13, Treyen-road, Truro
1899		Luxton, Thomas, B.A. and B.Sc. (Lond.), 116, North Boulevard, Hull
1908		Lyell, Henry Robert, Redcot, Dacres-road, Sydenham, S.E.
1908		Lynch, Gerald Roche, 160, Holland-park-avenue, W.
1873		Lyon, Isidore Bernadotte, Brigade Surgeon, Lieut.-Col., C.I.E., M.R.C.S. (Eng.), F.I.C., East India U.S. Club, 16, St. James's-square, S.W. ; and 164, Sutherland-avenue, W.
1874		Lyon, John George, F.I.C., The Aire Tar Works, Knottingley, Yorks.
1905		Lyon, Rudolf, 400, Huddersfield-road, Halifax
1886	Trans.	Lyons, Albert Brown, A.M. (Williams Coll.), M.D. (Mich.), 72, Brainard-street, Detroit, Mich., U.S.A.
1888		Maben, Thomas, 20, Great Pulteney-street, W.
1896		Macadam, Herbert Edwin, Odam's Wharf, Victoria Docks, E.
1888		‖Macadam, Stevenson John Charles George, F.I.C., Analytical Laboratory, 55, York-place, Edinburgh
1899		McAlley, James, c/o Messrs. M. Cockburn & Co., Ltd., Gowanbank Iron Works, Falkirk, N.B.
1903		Macara, Thomas, F.I.C., c/o Messrs. Lipton's, Ltd., Rouel-road, Bermondsey, S.E.
1887		‖McArthur, John, F.R.S.E., 262, Trinity-road, Wandsworth Common, S.W.
1890		‖MacArthur, John Stewart, 74, York-street, Glasgow
1910		McBeath, John William, Kimberley Mine Hospital, Kimberley, S. Africa
1888		McBretney, Edmund George, F.I.C., Newfield, Park-avenue, Castleford
1900		McCall, William, 13, Dargarvel-avenue, Dumbreck, Glasgow
1902		MacCallum, Douglas Archibald, Central-chambers, 93, Hope-street, Glasgow
1905		McCleary, William, 61, Station-rd., Pendlebury, near Manchester

Date of Election.		
1899		McClumpha, Robert, 372, Westgate-road, Newcastle-on-Tyne
1906	Trans.	McCombie, Hamilton, M.A. (Aberd.), B.Sc. (Lond.), Ph.D (Strassburg), A.R.C.S., F.I.C., The University, Edgbaston Birmingham
1907	Trans.	McConnan, James, D.Sc. (L'pool), M.Sc. (Vict.), Ph.D. (Jena) Frigorifico, Campana, F.C.R., Argentine, S. America
1904		McCourt, Cyril Douglas, A.C.G.I., 13, Rosslyn, Ellers-road Leeds
1875		‖McCowan, William, F.I.C., Essex Wharf, Narrow-street, Limehouse, E.
1899		McCracken, James, Ballantrae, Roxburgh-circus, Cardonald, N.B
1896	Trans.	McCrae, John, jun., Ph.D. (Heidelberg), F.I.C., Governmen Laboratories, P.O. Box 1080, Johannesburg, S. Africa
1899		McCreath, William Dunlop, Quantock Vale Cider Co., Ltd. North Petherton, Bridgwater
1890		‖McCubbin, William Alexander, F.I.C., May Cottage, Neston, Cheshire
1897		MacCulloch, Charles, Auckland Club, Auckland, New Zealand
1894		McCutcheon, James, Meniehaus, Woodend-drive, Jordanhill, Glasgow
1903		Macdonald, David Baird, 82, Hinckley-road, Leicester
1901		Macdonald, F. G., Durban Roodeport Gold Mining Co., Ltd., P.O. Box 111, Roodeport, Transvaal, S. Africa
1894	Trans.	MacDonald, George William, M.Sc. (Melbourne), Geddes House, Burch-road, Gravesend
1906		Macdonald, Thomas, c/o Indian Fisheries Co., Cochin, Southern India
1891		MacDonald, William, A.R.C.S., A.R.S.M., F.I.C., Assistant Postal Secretary, Peking, China
1904		McDougall, Arthur Thomas, B.A. (Lond.), Beaufort Cottage, Wellington-road, Bow, E.
1874		McDougall, John, Clifton House, Greenwich Park, S.E.
1906		McDowall, John, c/o H. Monson, Esq., Sabaieh, Upper Egypt
1906		Mace, William Ethrington, Box 662, General Post Office, Montreal, Canada
1886		MacEwan, Peter, 64, Southwood-lane, Highgate, N.
1898		McEwen, Antholl Francis, 709, Torrey-building, Duluth, Minnesota, U.S.A.
1895		MacFarlane, Alexander, Loch Sloy, Polefield, Blackley, Manchester
1891		Macfie, Robert Andrew Scott, M.A. (Cantab.), B.Sc. (Edin.), 34, Moorfields, Liverpool

Date of Election.			
1909			McGillvray, John Esson, M.A. (Edin.), Henry Smith School, Hartlepool
1895			McGlashan, John, Cawnpore Sugar Works, Cawnpore, India
1887	Trans.		McGowan, George, Ph.D. (Leipzig), F.I.C., 21, Montpelier-road, Ealing, W.
1908			MacGregor, Gregor, M.A. and B.Sc. (Glas.), Giffen-park, Dysart, Fife, N.B.
1893			McGregory, Joseph Frank, Prof., Colgate University, Hamilton, N. Y., U.S.A.
1906			McIntosh, David, Jamaica College, Kingston, Jamaica
1890			Macintyre, Alfred Edgar, Ph.D., The Chemical Laboratory, Dominion Arsenal, Quebec, Canada
1901	Trans.	C. 1910-	McKenzie, Alexander, M.A. and D.Sc. (St. Andrews), Ph.D. (Berlin), Birkbeck College, Bream's Buildings, Chancery-lane, E.C.
1897	Trans.		Mackenzie, John Edwin, D.Sc. (Edin.), Ph.D. (Strassburg), 11, Ramsay-gardens, Edinburgh
1902			Mackenzie, John Ross, Worcester Brewery, Worcester
1899			‖Mackenzie, Thomas, 4, Church-street, Inverness
1900			Mackenzie, Thomas Ebenezer, The Capillitas Copper Co., Ltd., Pilciao, Provincia de Catamarca, Argentine, S. America
1893			McKerrow, Charles Alexander, Wingfield, Wilmslow, Cheshire
1892			McKerrow, William James, D.Sc. (Tübingen), F.I.C., 97, Coldharbour-road, Redland, Bristol
1897			Maclaurin, James Scott, D.Sc. (N.Z.), Wellington, New Zealand
1868	Trans.	C. 1871-4, 80-4, 95-9. V.P. 1887-90, 1901-04	‖McLeod, Herbert, Prof., Hon. LL.D. (St. Andrews), F.R.S., 37, Montague-road, Richmond, Surrey
1899			McLeod, James, F.I.C., Gas Works, Greenock, N.B.
1903			MacMahon, Frederick William, 31, Marler-road, Forest Hill, S.E.
1879			‖Macmillan, James Laker, 98, Phillip-street, Sydney, N.S.W.
1889	Trans.		‖McMurtry, George Cannon, A.R.S.M., A.R.C.S., Templemore, Richmond, Nelson, New Zealand
1880			Macnab, William, F.I.C., 10, Cromwell-crescent, S.W.
1885	Trans.		‖Macnair, Duncan Scott, Ph.D. (Würzburg), B.Sc. (Lond.), 67, Braid-avenue, Edinburgh
1899			Main, Hugh, B.Sc. (Lond.), Almondale, Buckingham-road, South Woodford, N.E.
1900			Mair, William, 37, Morningside-drive, Edinburgh
1902	Trans.		Maitland, William, D.Sc. (Aberd.), Heriott-Watt College, Edinburgh
1892			Major, George Harry, Devonshire-street, Ardwick, Manchester

Date of Election.			
1906			Majumdar, Tarak Nath, 37, Lower Chitpore-road, Calcutta, India
1894			Makin, Charles James Shaw, F.I.C., Thorn Bank, Leamington
1885	Trans.		‖Mallet, Frederic Richard, F.I.C., 20, King's-avenue, Ealing, W.
1857	Trans.	V.P. 1888-91	Mallet, John William, Prof., Ph.D. (Göttingen), M.D. (Louisiana), LL.D. (Princetown, Pennsylvania, and Johns Hopkins), F.R.S., University of Virginia, Albemarle Co., Va., U.S.A.
1897			Mallinson, Willie Lee, Gawthorp-green, Kirkheaton, nea Huddersfield
1904			Mander, Alfred, Belle Vue House, Malvern
1903			Mander, Percy George, B.Sc. (Lond.), The Grammar School, Doncaster
1903			Mann, Ernest William, Lyndale, Northfield-road, King's Norton, Birmingham
1903			Mann, John Christopher, 33, Nicholls-street, West Bromwich
1902			Mann, William, B.Sc. (Lond.), 84, Inchmery-road, Catford, S.E.
1896			Manners, Hugh, M.A. and B.Sc. (Glas.), Academy House, Airdrie, N.B.
1908			Mansfield, Herbert, B.Sc. (Lond.), A.I.C., 70, Stapleton-hall-road, Stroud Green, N.
1897			Mansford, Charles John Jodrell, B.A. (Lond.), The Gramma School, Dartford, Kent
1910			Marcan, Alexander, A.I.C., Royal Mint, Bangkok, Siam
1895			‖Marchant, Robert Charles, Walnut Tree Cottage, Andover
1905	Trans.		Marle, Ernest Robert, B.Sc. (Lond.), A.R.C.S., Hartley Universit College, Southampton
1907	Trans.		Marsden, Herbert, B.Sc. (Manc.), Bramford, Ipswich
1895			Marsden, Prosper Henry, The Royal Infirmary, Liverpool
1883	Trans.	C. 1902-7	‖Marsh, James Ernest, M.A. (Oxon.), F.R.S., University Museum, Oxford
1895	Trans.		Marshall, Arthur, A.C.G.I., F.I.C., Chief Chemical Examiner, Naina Tal, India
1907			Marshall, Hubert Frederick Sankey, c/o Société Anonyme des Ciments d'Egypte, Massarah, Cairo, Egypt
1890	Trans.		‖Marshall, Hugh, Prof., D.Sc. (Edin.), F.R.S., University College, Dundee
1896			Marshall, Percy Sykes, Union Laboratory, Half Moon-street, Huddersfield
1891			Marshall, Reginald Tom, Kingscote, Upper Lenham-road, Sutton, Surrey.
1887			‖Marshall, William, F.I.C., Laboratory, Ladybrook-road, Cheadl Hulme, Stockport
1897			Martin, Charles Henry, 40, Bolton-road, Pendleton, Salford

Date of Election.			
1902			Martin, Francis, 3, York-terrace, Eglinton-road, Plumstead, S.E.
1905			Martin, Francis Grimshaw, A.I.C., Haslemere, Spa-lane, Hinckley
1906			Martin, Frederick James, c/o The Raub Australian Gold Mining Co., Ltd., Raub, Pahang, Federated Malay States
1907			Martin, Gerald Hargrave, 3A, Church-road, Upper Norwood, S.E.
1906			Martin, George Frederick Wesley, 14, Castle-park, Lancaster
1898	Trans.		‖Martin, George Herbert, M.A. (Oxon.), The Grammar School, Bradford, Yorks.
1885			‖Martin, Gerald Ward, Lieut.-Col., 8, Petersham-terrace, Gloucester-road, S.W.
1907			Martin, Joseph, B.Sc. (Dun.), 25, Vernon-road, Leytonstone, E.
1901			Martin, Nicholas Henry, Ravenswood, Low Fell, Gateshead-on-Tyne
1903			Martin, William George, B.Sc. (Wales), Royal School, Armagh, Ireland
1902			Martindale, William Harrison, Ph.D. (Marburg), 10, New Cavendish-street, W.
1871			‖Martineau, George, 21, Mincing-lane, E.C.; and Gomshall Lodge, Gomshall, Surrey
1887			‖Martineau, Sydney, Streatham-grove, Norwood, S.E.
1898			Mascarenhas, John Charles, 66, Wynndale-road, South Woodford, Essex
1851	Trans.	C. 1858-9, 75-7 V.P. 78-81	Maskelyne, Mervyn Herbert Nevil Story, M.A. and Hon. D.Sc. (Oxon.), F.R.S., F.I.C., Salthrop, Wroughton, Wilts.
1905			Mason, Arthur Walter, B.Sc. (Lond.), Norvic, Windsor-gardens, North Shields
1890			Mason, Francis Herbert, P.O. Box 31, Paso Robles, Cal., U.S.A.
1882	Trans.		Masson, David Orme, Prof., M.A. and D.Sc. (Edin.), F.R.S., The University, Melbourne, Australia
1897			Masters, Edward, Rock Mount, 186, Hinckley-road, Leicester
1873			‖Masters, William, St. Erme, The Hall-road, Cheltenham
1906			Mastin, John, Woodleigh House, Totley Brook, near Sheffield
1904			Mathews, Harold Joseph Clarke, Massey's Burnley Brewery, Ltd., Burnley, Lancs.
1909			Matchett, Andrew Sneddon, 13, Bute-gardens, Cathcart, N.B.
1902			Mathieson, Robert, J.P., Rill Bank, Innerleithen, Peeblesshire
1876	Trans.		‖Matthews, Charles George, F.I.C., Abendberg, 31, Stapenhill-road, Burton-on-Trent
1907			Matthews, Charles Pask, B.Sc. (Lond.), A.I.C., Tiffin's Boys' School, Kingston-on-Thames

Date of Election.			
1880	Trans.	C. 1906-09	‖Matthews, Francis Edward, Ph.D. (Göttingen), F.I.C., Ash Lawn, The Glebe, Blackheath, S.E.
1884			‖Matthey, Edward, Col., C.B., A.R.S.M., 31a, Weymouth-street, W.
1870		C. 1877-9	Matthey, George, Assoc.Inst.C.E., F.R.S., 78, Hatton-garden, E.C.
1893			‖Mawer, William Frederick, 332, Kennington-road, S.E.
1865			‖Maxwell, Theodore, B.A. and M.D. (Cantab.), F.R.C.S. (Edin.), B.Sc. (Lond.), 29, Woolwich Common, S.E.
1909	Trans.		May, Percy, B.Sc. (Lond.), 126, Cazenove-road, Stamford Hill, N.
1909			May, Rowland Josiah, Granaugh Villa, Dunbar, N.B.
1908			Maywald, Frederick John, 89, Pine-street, New York City, U.S.A.
1892			Meacham, Charles Stephen, c/o Messrs. Ohlsson's Cape Breweries, Ltd., Newlands, Cape Town, S. Africa
1908			Meade, Alwyne Harcourt, Cedar House, St. Neots
1898			Meads, Charles James, 19, Park-place-west, Sunderland
1910	Trans.		Meanwell, Charles Wright, F.I.C., 15, Woodlands-crescent, Muswell Hill, N
1904			Mears, Francis D'Oyley, jun., c/o The Campbell Ehrenfried Co., Ltd., Auckland, New Zealand
1901	Trans.		Mees, Charles Edward Kenneth, D.Sc. (Lond.), 76, Canterbury-road, Croydon
1908			Meggitt, Alfred Ash, B.Sc. (Lond.), Government of Eastern Bengal and Assam, Dacca, Eastern Bengal, India
1896			Meggitt, Loxley, F.I.C., c/o C.W.S., Ltd., Wheatsheaf Works, Alexandria, Sydney, N.S.W.
1871	Trans.	C. 1883-7, 90-91 F.S. 1891-1902 V.P. 1902-05 P. 1905-7	‖Meldola, Raphael, Prof., F.R.S., F.I.C., Finsbury Technica College, Leonard-street, E.C.; and 6, Brunswick-square, W.C.
1905	Trans.		Meldrum, Andrew Norman, D.Sc. (Aberd.), Chemical Department, The University, Manchester
1894			Melland, Godfrey, M.Sc. (Vict.), A.R.S.M., F.I.C., Chemica Department, The Polytechnic, Woolwich, S.E.
1908			Melling, Samuel Ernest, F.I.C., The Cliff, Higher Broughton, Manchester
1902	Trans.		Mellor, Joseph William, D.Sc. (N.Z.), The Villas, Stoke-on-Trent
1875			‖Melmore, Pattinson Banks, Chemical Laboratory, Maryport
1902			Mence, George Augustus Henry, B.Sc. (Lond.), The Gramma School, Lincoln
1900	Proc.		Menzies, Alan Wilfrid Cranbrook, M.A. and B.Sc. (Edin.), Kent Chemical Laboratory, The University, Chicago, Ill., U.S.A.

Date of Election.			
1908			Menzies, Frederick Norton Kay, M.D., B.S. and F.R.C.P. (Edin.), D.P.H. (R.C.P.S. Lond.), 79, Davies-street, Berkeley-square, W.
1889			Mercer, Thomas, F.I.C., Devonshire Club, Eastbourne
1901			Meredith, William, 63, Albion-place, Ulverston, Lancs.
1896			Merrett, William Henry, A.R.S.M., F.I.C., Hatherley, Grosvenor-road, Wallington, Surrey
1908			Merrick, Arnold, 66, Rothbury-terrace, Newcastle-on-Tyne
1891			Merrils, Frederick Johnson, Haxworth-chambers, 25, Figtree-lane, Sheffield
1897			Merson, George Fowlie, 17, St. Ann's-square, Manchester
1876	Trans.	C. 1884-8, 1897-1901 V.P. 1906-9	‖Messel, Rudolph, Ph.D. (Tübingen), 147, Victoria-street, Westminster, S.W.
1909			Metzger, Floyd Jay, Columbia University, New York City, U.S.A.
1900			Meyer, Hans, Ph.D., 1, Salmgasse, Prague, Bohemia
1904			Middleditch, Bernard, B.A. (Cantab.), Woodcroft, Harrow-on-the-Hill
1906			Middleton, Alexander Edmund, Government Laboratory, Clement's Inn-passage, Strand, W.C.
1888	Trans.	V.P. 1901-04	‖Miers, Henry Alexander, Principal, M.A. and D.Sc. (Oxon.), F.R.S., 23, Wetherby-gardens, S.W.
1908			Miles, William Herbert, 3, Liversidge-road, Higher Tranmere, Birkenhead
1908			Millar, Charles James, c/o Messrs Turner, Morrison & Co., 6, Lyons-range, Calcutta, India
1892	Trans.		Millar, James Hill, D.Sc. (Birm.), F.I.C., Chief Chemist's Laboratory, St. James's Gate Brewery, Dublin
1891			‖Millard, Edgar James, 35–42, Charlotte-street, Great Eastern-street, E.C.
1905			Millen, John Dunlop, Mount Bischoff Mine, Waratah, Tasmania
1880	Trans.		‖Miller, Alexander Kenneth, Ph.D. (Würzburg), F.I.C., Kilvert's-buildings, Withy-grove, Manchester
1901			Miller, Edward Holl, c/o Anglo Australian Milk Co., Clydebank, Sale, Victoria, Australia
1889	Trans.		Miller, James Bruce, A.I.C., Rubislaw Den North, Aberdeen
1887			Miller, John A., M.Sc. (Illinois), Ph.D. (Berlin), 44 & 45, Lewis Block, Buffalo, N.Y., U.S.A.
1885	Trans.		‖Miller, Norman Harry John, Ph.D. (Würzburg), F.I.C., Harpenden, Herts.
1898			Miller, William Lash, B.A. (Toronto), Ph.D. (Munich), 50, St. Alban-street, Toronto, Canada
1893	Trans.		‖Mills, Charles, F.I.C., P.O. Box 112, Kroonstad, S. Africa

Date of Election.			
1862	Trans.	C. 1868-72, 75-6, 80-4, 1903-06	‖Mills, Edmund James, Prof., D.Sc. (Lond.), LL.D. (Glas.), F.R.S., F.I.C., 64, Twyford-avenue, West Acton, W.
1906			Mills, Herbert Arthur, 3, Croxted-road, West Dulwich, S.E.
1898	Trans.		Mills, William Hobson, M.A. (Cantab.), Sc.D. (Tübingen), The Northern Polytechnic Institute, Holloway, N.
1905	Trans.		Mills, William Sloan, M.A., D.Sc. and B.E. (R.U.I.), Chemical Dept., The Polytechnic, Woolwich, S.E.
1885			‖Milne, Alexander, Lieut.-Col. I.M.S., M.A., M.B. and M.Ch. (Aberd.), H.M.'s Mint, Bombay, India
1908			Minett, Edward Pigott, M.D. (Brussels), M.R.C.S. (Eng.), L.R.C.P. (Lond.), Guys Hospital, S.E.
1887			Mingaye, John Charles Henderson, F.I.C., Department of Mines, Assay Branch, Sydney, N.S.W.
1898			‖Mitchell, Albert Henry, B.Sc. (Lond.), F.I.C., Borough Analyst's Laboratory, Hensleigh-road, Tiverton
1907	Trans.		Mitchell, Herbert Victor, 26, Brookfield-avenue, Walthamstow, N.E.
1905			‖Modi, Edalji Manekji, D.Sc. (N. Carolina), LL.D. (Tennessee), Litt.D. (Providence, Ohio), Opposite Grant-road-station, Sleater-road, Bombay, India
1899			Mohr, Bernard, Ph.D. (Heidelberg), 69A, Parliament-hill, Hampstead, N.W.
1901	Trans.		Moir, James, M.A. and D.Sc. (Aberd.), Chemical Laboratory, Mines Department, Plein-street, Johannesburg, S. Africa
1893			Mole, Herbert Bloome, St. Anne's, Morgan-road, Reading
1902			Molesworth, Francis Hylton, Jersey-road, Artarmon, Sydney, N.S.W.
1899			Molson, John Cavendish, M.D. (Chicago), L.R.C.P. (Lond.), 17, Vernon-terrace, Brighton
1899			Mond, Emile Schweich, 22, Hyde-park-square, W.
1892			Mond, Robert Ludwig, M.A. (Cantab.), F.R.S.E., The Poplars, 20, Avenue-road, Regent's Park, N.W.
1879			‖Mondy, Edmund Felix, A.R.S.M., Dacca, 96, Huron-road, Balham, S.W.
1903	Trans.		Monier-Williams, Gordon Wickham, M.A. (Oxon.), Ph.D. (Freiburg), F.I.C., Chessington, Surbiton, B.O., Surrey
1904			Montgomery, Jack Percival, Ph.D. (Virginia), A.M. (Clarksville), Agricultural College, Starkville, Miss., U.S.A.
1887	Trans.	C. 1899-1900 1905-8	‖Moody, Gerald Tattersall, D.Sc. (Lond.), F.I.C., Lorne House North Dulwich, S.E.
1897			Moon, Philip George Gregory, Hillcroft, Alexandra-road, Uppe Parkstone, Dorset
1892			‖Moor, Cresacre George, M.A. (Cantab.), F.I.C., Savoy House 115, Strand, W.C.

Date of Election.			
1903			Moore, Alfred Ernest, B.A. and B.Sc. (Lond.), Escuela Normal Regional, Corrientes, Argentine, S. America
1903			Moore, Arthur, 128, Felbrigge-road, Goodmayes, Essex
1905	Trans.		Moore, Charles Watson, M.Sc. (Vict.), Ph.D. (Munich), The Wellcome Chemical Research Laboratory, 6, King-street, Snow-hill, E.C.
1891			Moore, Frederick Herbert, 39, Lime-street, E.C.
1907			Moore, John Edward Langford, Walton Cottage, Loughboro'-park, S.W.
1902			Moore, Thomas Henry, c/o Messrs. Burroughs, Wellcome & Co., 45, Lafayette-street, New York, U.S.A.
1904	Trans.		Moore, Tom Sidney, M.A. (Oxon.), B.Sc. (Lond.), Magdalen College, Oxford
1908			Morewood, Capel Darcy, Ferndale, Frodingham, Doncaster
1895			Morgan, David James, M.A., M.D. and B.C. (Cantab.), D.P.H. (Lond.), Medical Officer of Health, Swansea
1897			Morgan, Frederick Filmer de, 57, Woodberry-crescent, Muswell Hill, N.
1898	Trans.	C. 1909-10 S. 1910-	‖Morgan, Gilbert Thomas, D.Sc. (Lond.), A.R.C.S., F.I.C., Royal College of Science, South Kensington, S.W.; and 19, Fawcett-street, Redcliffe-gardens, S.W.
1908			Morgan, Howard Houlston, B.Sc. (Lond.), A.R.C.S., Technical College, Auckland, New Zealand
1888			‖Morgan, John James, F.I.C., Brookside, Harrington, Cumberland
1900			Morgan, John Livingston Rutgers, Prof., A.M. and Ph.D. (Leipzig), B.Sc. (Rutgers College), Columbia University, New York, U.S.A.
1880	Trans.		Moritz, Edward Ralph, Ph.D. (Göttingen), F.I.C., 45, Great Tower-street, E.C.
1879	Trans.	C. 1887-90, 96-1900	‖Morley, Henry Forster, M.A. and D.Sc. (Lond.), F.I.C., 5, Lyndhurst-road, South Hampstead, N.W.
1909			Morley, William Norton, B.Sc. (Lond.), 325, Brownhill-road, Catford, S.E.
1895	Trans.		‖Morrell, Robert Selby, M.A. (Cantab.), Ph.D. (Würzburg), c/o Messrs. Mander Bros., Wolverhampton; and South Bank, Compton, Wolverhampton
1892			Morris, Albert, B.A. and B.Sc. (Lond.), Fern Bank, Ashton-under-Lyne
1890			Morris, Arthur Higgs, 72, Chorley-new-road, Bolton, Lancs.
1900			Morris, Edgar Ford, M.A. (Oxon.), c/o Cornbrook Chemical Co., Ltd., Newbridge Mills, Stockport, Cheshire
1905			Morris, Eric Haydn, Box 1302, General Post Office, Johannesburg, S. Africa

Date of Election.			
1891			Morris, Joseph, Ph.D., Fern Bank, 8, Boardman-street, Eccles, Manchester
1905			Mortimer, Alfred, B.A. (Oxon.), Wolverley School, Kidderminste
1872			Morton, Edward Handfield, 88, Wigmore-street, W.
1893			Morton, Frederick, Chemical Works, Milnsbridge, Huddersfield
1890	Trans.		Mosenthal, Henry de, F.I.C., 220, Winchester-house, Old Broad-street, E.C.
1896			Moss, Francis Ambrose, Greenbushes, Western Australia
1871			‖Moss, Richard Jackson, F.I.C., St. Aubyns, Ballybrack, Co Dublin
1898			Moss, William Edward, 2, Windermere-terrace, Princes-park Liverpool
1886			‖Moul, Frank, F.I.C., 5, Blakesley-avenue, Ealing, W.
1884			‖Moyle, Robert Edward, M.A. (Oxon.), Heightley, Chudleigh S. Devon
1902			Müller, Christian, 6, Baronsfield-road, East Twickenham, Middlese
1859	Trans.	C.1863-6 F.S. 69-85 P. 85-7	‖Müller, Hugo, Ph.D. (Göttingen), LL.D. (St. Andrews), Hon D.Sc., (Manc.) F.R.S., 13, Park-square East, Regent's Park N.W.
1909	Trans.		Müller, Robert, Ph.D. (Zürich), 9, Schanzengraben, Zürich Switzerland
1871	Trans.	C. 1890-4	‖Muir, Matthew Moncrieff Pattison, M.A. (Cantab.), Hillcrest Farnham
1870			‖Muirhead, Alexander, D.Sc. (Lond.), F.R.S., The Lodge, Shortlands, Kent
1906			Mukerjee, Ram Chandra, Prof., B.A. (Allahabad), Maharaja' College, Jaipur, Rajputana, India
1909			Müller, John, B.A. (Cape of Good Hope), Government Analytica Laboratory, Grahamstown, Cape Colony, South Africa
1907			Mummery, Charles Samuel, Central Technical College, Sout Kensington, S.W.
1906			Mummery, William Rest, F.I.C., c/o Hygienic Dairy Society, Ltd. Salisbury
1893	Proc.		Munby, Alan Edward, M.A. (Cantab.), Royal Societies' Club St. James'-street, S.W.
1902			Mundey, Alfred Holley, 14, Wrottesley-road, Plumstead, Kent
1876	Trans.		Munro, John May Herbert, D.Sc. (Lond.), M.R.C.S. (Eng.) L.R.C.P. (Lond.), F.I.C., 12, Grosvenor-place, Bath
1888			Munroe, Charles Edward, Prof., George Washington University Washington, D.C., U.S.A.
1900			Munton, Frederick Thomas, The Oak House, Winsford, Cheshire
1910			Murch, Douglas Wilshin, 74, Stafford-street, Wednesbury
1907			Murgatroyd, Louis, 1, Carlton-drive, Heaton, Bradford
1901			Murphy, Albert John, 28, Great George-street, Leeds

Date of Election		
1904		Murray, Benjamin Lindley, A.M. (Columbia), B.S. (Mich.), 19, University-place, New York, U.S.A.
1906		Murray, Thomas Jenkins, M.Sc. (Birm.), Ph.D. (Leipzig), The University, Edgbaston, Birmingham
1890	Trans.	‖Murray, Thomas Smith, D.Sc. (Edin.),1, Nelson-street, Dundee
1869		‖Muspratt, Edmund Knowles, Hon. LL.D. (L'pool), F.I.C. Seaforth Hall, near Liverpool
1873		‖Muspratt, Sidney Knowles, 9, Church-street, Flint, N. Wales
1896		Muter, Alexander Henry Mitchell, F.I.C., Laboratory, 325, Kennington-road, S.E.; and The Châtclet, Horley, Surrey
1870	Trans.	‖Muter, John, Ph.D. (Rostock), F.I.C., Laboratory, 325, Kennington-road, S.E.; and The Châtelet, Horley, Surrey
1892	Trans.	Myers, William Shields, D.Sc. (N.J.), 71, Nassau-street, New York City, U.S.A.
1887		Nagel, David Henry, M.A. (Oxon.), Trinity College,Oxford
1903		Nairne, Urban Orlando Scotchburn, 7, Hawthorne-terrace, Ripple-road, Barking, Essex
1874		‖Napier, Arthur S., Prof., B.Sc., c/o Herren Mayer and Müller, 2, Prinz Louis Ferdinandstrasse, Berlin
1893		Napier, John Watson, Corporation Gas Works, Alloa, N.B.
1909		Napier, Thomas, c/o The Cassel Cyanide Co., Ltd., Maryhill, Glasgow
1900	Trans.	Napper, Sidney Scrivener, A.C.G.I., A.I.C., c/o Messrs. S. Cortauld and Co., Ltd., Foleshill-road, Coventry
1898		Nash, Leonard Myddelton, F.I.C., 3, Princess-road, Finsbury Park, N.
1900		Naylor, Ernest Brooks, M.Sc. (Vict.), A.I.C., Eversleigh, Gathurst, Wigan
1906		Naylor, George, 5, Albert-terrace, Promenade, Blackpool
1891		Naylor, William, 3, Garstang-road, Fulwood-park, Preston
1878	Trans.	Naylor, William Arthur Harrison, F.I.C., The British Drug House, Ltd., 22–30, Graham-street, City-road, N.
1910		Neal, George William, B.Sc. (Lond.), 8, Little Park-gardens, Enfield, Middlesex
1899	Trans.	Neale, Harry Ainley, Mission Junction, British Columbia
1908		Neech, Herbert Richard, 20, Colegrave-street, Lincoln
1910		Needs, Francis Edwin, 7, Effingham-road, St. Andrew's-Park, Bristol
1898		Neilson, Alexander MacGillivray, Umbilo Post Office, via Durban, Natal, S. Africa
1908	Trans.	Neogi, Punchānan, Prof., M.A. (Calcutta), Rajshahi College, Rajshahi, Eastern Bengal and Assam, India

Date of Election.		
1901		Neumann, Edgar David Maurice, M.A. (Oxon.), Ph. (Göttingen), A.I.C., 7 & 8, Idol-lane, E.C.
1878	Trans.	‖Nevile, Ralph Henry Christopher, Wellingore Hall, Lincoln
1871	Trans.	‖Nevill, Edmund Neville, F.R.S., F.I.C., Government Laborator Durban, Natal, S. Africa
1890	Trans.	Neville, Francis Henry, M.A. (Cantab.), F.R.S., La Vern Letchworth, Hitchin
1905	Trans.	Neville, Henry Allen Dugdale, B.Sc. (Lond.), F.I.C., Coun Technical Laboratories, Chelmsford
1892		‖Newall, John Fenton, 33, George-street, Manchester
1885		‖Newbolt, Francis George, M.A. (Oxon.) Balliol Colle Laboratory, Oxford
1901		Newbould, Herbert Simpson, 15, York-road, Heaton Moor, ne Stockport
1864		‖Newlands, Benjamin Edward Reina, F.I.C., 2, St. Dunstan hill, E.C.
1891		‖Newlands, William Peter Reina, 10, Cricklade-avenue, Streatha Hill, S.W.
1889		Newsholme, George Thomas Wilkinson, 27, High-stre Sheffield
1894	Trans.	Newth, George Samuel, F.I.C., Royal College of Science, Sou Kensington, S.W., and The Sheiling, Godstone, Surrey
1895		Newton, Charles Butterworth, M.Inst.C.E., Town Hall, Hull
1883		Newton, William, Ph.D. (Zürich), F.I.C., Dyne House, Gordon-street, W.C.
1899	Trans.	Nicholls, William Walter Scott, B.Sc. (Lond.), 230, Brockle road, Brockley, S.E.
1870	Trans.	‖Nicholson, Edward, Brigade Surgeon, Lieut.-Col., M.R.C. (Eng.), L.S.A. (Lond.), D.P.H. (Cantab.), F.I.C., 1, Hu kisson-street, Liverpool
1910		Nicholson, Philip Brady, c/o Messrs Simon-Carves, Ltd., Silve wood Colliery, Rotherham
1889		Nickels, Wallace Christopher, 41, Cheapside, E.C.
1892		Nickolls, John Bate, The Exchange, Malvern
1883	Trans.	Nicol, William Walker James, M.A. and D.Sc. (Edin.), F.I. 15, Blacket-place, Edinburgh
1900		Nightingale, Thomas Marginson, B.Sc. (Vict.), 375, Bridgma street, Bolton
1898		Nightscales, Thomas Arthur, 642, Holderness-road, Hull
1894		Nixon, Alfred, 7, Oak-road, Sale, Manchester
1869		Noble, Sir Andrew, Bart., K.C.B., D.C.L. (Dun.), F.R. Jesmond Dene House, Newcastle-on-Tyne
1908		Norman, Cyril Lawrence, 247A, Cavendish-road, Balham, S.W

Date of Election.			
1903	Trans.		Norman, George Marshall, B.Sc. (Lond.), A.R.C.S., A.I.C., 120, Walmersley-road, Bury, Lancs.
1889			Norman, John Thomas, 23, Leadenhall-street, E.C.
1908			Normand, Alexander Robert, M.A. and B.Sc. (Edin.), Wilson College, Bombay, India
1861			Norrington, Frederick, 5, Downfield-road, Clifton, Bristol
1892			Norris, Charles James, 31, Airedale-avenue, Chiswick W.
1909	Trans.		Norris, Roland Victor, M.Sc. (Manc.), 16, Roseneath-road, Clapham Common, S.W.
1897	Trans.		North, Barker, 22, Horton-park-avenue, Bradford
1892			Northing, John, The Murrough, Wicklow
1878			‖Norton, Thomas Herbert, Prof., Ph.D. (Heidelberg), D.Sc. (Hamilton), c/o The American Consulate, Theaterstrasse, 14, Chemnitz, Saxony, Germany
1901			Nunn, Arthur William, 57, Crouch-street, Colchester
1907			Nuttall, Walter Harold, F.I.C., Lyndhurst, Aldenham-road, Watford
1904			Oakden, William Edward, 2, Gledhow-terrace, South Kensington, S.W.
1910			Oakley, Robert O'Field, 54, Sydney-road, Hornsey, N.
1893	Trans.		Oates, William Henry, Townhead, Dore, Sheffield
1907			Oberländer, Otto, Ph.D. (Heidelberg), 29, Queen-street, E.C.
1903			O'Brien, Frederick, M.Sc. (L'pool.), Lynwood, Bishopsworth, Bristol
1902			O'Connor, Sinnott Valentine, Spawell House, Wexford
1890			Oddy, Robert Walter, F.I.C., Waterhouse, Toad-lane, Rochdale
1873			‖Odling, Walter, F.I.C., c/o Messrs. Bass and Co., Burton-on-Trent
1848	Trans.	S. 1856-69 V.P. 1869-73 P. 1873-5	Odling, William, Prof., M.A. (Oxon.), M.B. and F.R.C.P. (Lond.), Hon. Ph.D. (Leyden), F.R.S., F.I.C., 15, Norham-gardens, Oxford
1905			‖O'Farrelly, Alfons, M.A. (R.U.I.), 65a, Upper Leeson-street, Dublin
1902			Ogilvie, Allan, Levendale, Frodingham-road, Scunthorpe, Doncaster
1908			‖Oke, Alfred William, B.A. and LL.M. (Cantab.), 32, Denmark-villas, Hove, Sussex
1909			Okell, Frederick Leigh, F.I.C., c/o Straits Trading Co., Ltd., Singapore, Straits Settlements
1908			Okell, Stanley Allen Warrington, 27, King's-road, Ealing, W.
1901			Oldershaw, William, Strelley, Nottingham
1904			Oldfield, Laurel Cecil Francis, 5, Pump-court, Temple, E.C.
1906			Oliver, Edgar Gale, M.A. (Cantab.), Chigwell School, Essex

Date of Election.		
1889		O'Mahony, Daniel John, Municipal-buildings, Cork
1901		Oram, Frank, Market-place, Romsey
1890	Trans.	Ormandy, William Reginald, D.Sc., 53a, Barton-arcade, Manchester
1869		‖Orme, Temple A., 213, Uxbridge-road, W.
1872		‖Ormerod, Joseph Arderne, M.D. (Oxon.), M.R.C.S. (Eng.), F.R.C.P. (Lond.), The Medical Committee Room, St. Bartholomew's Hospital, E.C.
1887		‖Ormiston, Archibald R., Braeholm, Helensburgh; and 213, St. Vincent-street, Glasgow
1893		Orr, Alexander, Norwich-chambers, 35A, Bligh-street, Sydney, N.S.W.
1881		Orr, John Bryson, Crossacres, Much Woolton, Liverpool
1897	Trans.	‖Orton, Kennedy Joseph Previté, Prof., M.A. (Cantab.), Ph.D. (Heidelberg), F.I.C., Llwyn Eithin, and University College of North Wales, Bangor
1881	Trans.	O'Shea, Lucius Trant, M.Sc. (Sheffield), B.Sc. (Lond.), The University, Sheffield
1887		Ostersetzer, Julius, F.I.C., c/o Messrs. W. and H. M. Goulding, Manure Manufacturers, North Wall, Dublin
1883	Trans.	O'Sullivan, James, F.I.C., High Bank, Burton-on-Trent
1899		O'Sullivan, John, 1649, Barclay-street, Vancouver City, British Columbia
1887		‖O'Sullivan, Patrick Thomas, M.D. and B.Ch. (R.U.I.), 20, South Mall, Cork
1891		Ough, Lewis, Fernleigh, St. James's-road, Leicester
1888		Overbeck, Otto Christoph Joseph Gerhard Ludwig, Chantry House, Great Grimsby
1887		‖Overend, Frederick Lawrence, B.A. (Oxon.), 74, Rowley-street, Walsall
1909		Owen, Robert Cecil, B.Sc. (Lond.), 89, Foregate-street, Chester
1906		Oxland, Charles Harold, B.Sc. (Manc.), The Grammar School, Wellingborough
1909		Painter, Frederick Hubert, B.Sc. (Lond.), 29, Talbot-road, Winton, Bournemouth
1884		‖Pallister, John William, B.Sc. (Lond.), 107, Waverley-road, Bradford
1910		Palmer, Gilbert, B.Sc. (Lond.), 17, Wansbeck-gardens, West Hartlepool
1888		Palmer, Henry John, Banff, Alberta, Canada
1899		Palmer, Thomas Henry, c/o Broken Hill Junction North Silver Mining Co., P.O. Box 98, Broken Hill, N.S.W.

Date of Election.			
1902			Panisset, Sydney Glyde Stephen, Lyme Villa, Cherry Hinton, Cambridge
1899	Trans.		Panting, Laurence Christopher, M.A., M.D. and B.Ch. (Oxon.), 45, Lemon-street, Truro
1900			Pardy, Alexander, Central Experiment Farm, Cedara, Natal, S. Africa
1898			Parker, Alfred James, c/o Mrs. Wintere, Papatoitoi, Auckland, New Zealand
1897			Parker, Charles Henry, 106, Tettenhall-road, Wolverhampton
1882			Parker, Joseph Richard, Avondale, 129, Kyverdale-road, Stoke Newington, N.
1894	Trans.		Parker, Matthew Archibald, Prof., B.Sc. (Glas.), University of Manitoba, Winnipeg, Canada
1882			‖Parker, Robert Henry, Ravenscar, Orchard-road, Blackheath, S.E.
1901			Parkes, Albert Edward, F.I.C., Chemical Laboratory, 43, Whitehorse-street, Stepney, E.
1890			Parkes, Thomas, M.A. (Cantab.), 2, Gawber-road, Barnsley
1906			‖Parkin, John, M.A. (Cantab.), Blaithwaite, Carlisle
1865	Trans.		‖Parkinson, James, Queen's-chambers, Pirie-street, Adelaide, S. Australia
1893			‖Parrish, Samuel, B.Sc. (Lond.), 80, Grange-avenue, Chapeltown-road, Leeds
1892			Parry, Ernest John, B.Sc. (Lond.), F.I.C., Thanet House, 56A, Great Dover-street, S.E.
1903	Proc.		Parry, William, B.Sc. (Lond.), Incewood, Waterloo-park, Liverpool
1870			Patchett, Isaac, F.I.C., 59, Holyrood-terrace, Carlinghow, Batley
1894	Trans.		Paterson, David, F.R.S.E., Lea Bank, Rosslyn, Midlothian
1885	Trans.		Patterson, George, F.I.C., The Manbré Saccharine Co., Hammersmith, W.
1896			Patterson, Joseph William, 20, South-road, West Hartlepool, Durham
1870	Trans.		Patterson, Thomas Law, F.I.C., Maybank, Finnart-street, Greenock
1904	Trans.		Patterson, Thomas Stewart, D.Sc. (Lond.), Ph.D. (Heidelberg), Chemical Department, The University, Glasgow
1863	Trans.	{ V.P. 1891-4 }	Pattinson, John, F.I.C., 10, Dean-street, Newcastle-on-Tyne
1868	Trans.		‖Paul, Benjamin Horatio, Ph.D. (Giessen), Analytical Laboratory, 13, Fenchurch-street, E.C.; and Parkside, Kingston Vale, Putney, S.W.
1885	Trans.		Paul, Lewis Gordon, Ph.D. (Tübingen), F.I.C., Market Hall-chambers, King-street, Huddersfield
1901			Pay, Walter Herbert, Government Explosives Office, P.O. Box 943, Durban, Natal, S. Africa

Date of Election.			
1896			Payne, Arthur, c/o Messrs. Mawson and Swan, Moseley-street, Newcastle-on-Tyne
1893			Payne, George Frederick, M.D. (Atlanta), 60, Armstrong-street, Atlanta, Georgia, U.S.A.
1899	Trans.		Peachey, Stanley John, School of Technology, Whitworth-street, Manchester
1901			Peacock, Arthur, B.Sc. (Vict.), The Brebner Schools, Bloemfontein, S. Africa
1900			Pearce, Ernest Vivian, c/o Transvaal Consolidated Lands, Ltd., Groenfontein Mine, Potgietersrust, Transvaal, S. Africa
1874			Pearce, William, M.P., Chemical Works, Bow Common, E.
1906			Pearse, Leonard Edward Beard, A.R.S.M., 15, Woodfield-road, Ealing, W.
1908			Pearson, George Edward, c/o Messrs. Burroughs, Wellcome & Co., Snow Hill Buildings, E.C.
1908			Pearson, John William, B.A. (Cantab.), 19, Palmyra-square, Warrington
1894	Trans.		Pearson, William Henry, 6, Fenchurch-buildings, E.C.
1902			Peck, John Wicliffe, 13, Springwell-avenue, Harlesden, N.W.
1894			Peden, John, Chemical Laboratory, 11, Duff-street, Greenock
1870	Trans.	V.P. 1907-10	‖Pedler, Sir Alexander, Prof., C.I.E., F.R.S., F.I.C., 28, Stanhope-gardens, Queen's Gate, S.W.
1904			Pell, Alfred, 44, Cumballa-hill, Bombay, India
1886	Proc.		Pendlebury, William Henry, M.A. (Oxon.), Woodford House, Mountfield, Shrewsbury
1905			Penn, Francis Richard, B.Sc. (Lond), A.R.C.S., 11, Crawshaw-avenue, Pudsey, Leeds
1870			Penney, Mulgrave Daniel, 11, High-street, Hull
1895			Pennington, William Henry, Westgate, Longley-road, Worsley
1905			Pennycuick, Thomas, B.Sc. (Lond.), 6, Darley-drive, West Derby, Liverpool
1886			Pentecost, Stephen James, Alexandra-mount, Mapperley Hill, Nottingham
1884	Trans.	C. 1906-10	Perkin, Arthur George, Prof., F.R.S., F.I.C., Grosvenor Lodge, Grosvenor-road, Leeds
1891	Trans.		‖Perkin, Frederick Mollwo, Ph.D. (Würzburg), 199, Piccadilly, W.
1884	Trans.	C. 1891-5 V.P. 1906-9	†Perkin, William Henry, Prof., Ph.D. (Würzburg), Hon. Sc.D. (Cantab.), Hon. LL.D. (Edin.), F.R.S., F.I.C., Fairview, Wilbraham-road, Fallowfield, Manchester
1906			Perkins, William Hughes, B.Sc. (Manc.), The University, Leeds
1890	Trans.		‖Perman, Edgar Philip, D.Sc. (Lond.), University College, Cardiff
1905			Perrott, Bert, Bryn Clydach, Neath Abbey, Neath
1908			Perry, Frank, 63, Tunnel-street, Coseley, Bilston

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† Longstaff Medallist 1900.

Date of Election			
1900			Pettigrew, Robert, 44, Mosley-street, Manchester
1902	Trans.		Phelps, John, M.A. (Oxon.), The Royal Mint, E. ; and Newcroft, Egmont-road, Sutton, Surrey
1881			Philip, Arnold, B.Sc. (Lond.), A.R.S.M., F.I.C., Chemical Laboratory, H.M. Dockyard, Portsmouth
1897	Trans.	C. 1910-	Philip, James Charles, M.A. and D.Sc. (Aberd.), Ph.D. (Göttingen), Royal College of Science, South Kensington, S.W.
1904			Phillips, George Frederick Tyler, B.Sc. (Lond.), University College, Southampton
1897	Trans.		Phillips, Harry Edward William, M.A. and B.Sc. (Oxon.), Church House, Summertown, Oxford
1882			Phillips, Henry Harcourt, Lynwood, Turton, Lancs.
1902	Trans.		Phillips, Percy Philip, Ph.D. (Göttingen), Thomason Engineering College, Rurki, U.P., India
1908			Phillips, Thomas Richard, 5, Enmore-road, Putney, S.W.
1900			Phillpotts, Geoffrey Surtees, B.A. (Cantab.), 108, James'-street, Dublin
1905			Phipson, Percy Barker, c/o Messrs. J. Staples and Co., Ltd., Wellington, New Zealand
1909	Trans.		Pickard, Joseph Allen, B.Sc. (Lond.), A.R.C.S., 3, West Kensington-terrace, W.
1897	Trans.		‖Pickard, Robert Howson, D.Sc. (Lond.), Ph.D. (Munich), B.Sc. (Birm.), F.I.C., Municipal Technical School, Blackburn
1891			Pickering, Michael Samuel, B.Sc. (Lond.), 38, Price-street, Burslem
1878	Trans.	C. 1886-7, 89-93, 1901-04.	‖Pickering, Spencer Percival Umfreville, M.A. (Oxon.), F.R.S., F.I.C., Harpenden, Herts.
1906	Trans.		Pickles, Samuel Shrowder, D.Sc. (Vict.), Imperial Institute, S.W.
1890	Trans.		‖Picton, Harold, B.Sc. (Lond.), Clacton College, Clacton-on-Sea
1909	Trans.		Picton, Norman, B.Sc. (Wales), Ph.D. (Leipzig), 4, Pembroke-square, Kensington, W.
1894			Pike, Ernest Brooke, Northern Outfall, Beckton, Woolwich, E.
1903			Pike, Henry George, 8, Eastbourne-avenue, Claremont-road, Bath
1874	Trans.		‖Pike, William Herbert, Prof., Ph.D. (Göttingen), Sandhills, Salcombe, S.O., Devon
1883			‖Pilley, John J., Ph.D., 167, Camberwell-grove, S.E.
1896			Pilley, Thomas William, 33, Grove-hill-road, Denmark Hill, S.E.
1904			Pinchbeck, Gerald, Sunnyside, Lower Seedley-road, Pendleton, Manchester
1909			Ping, Francis Hugh, A.R.C.S., 10, Forest-place, Whipps Cross-road, Leytonstone, N.E.

Date of Election.		
1889		Ping, William, 14, Selsdon-road, Wanstead, N.E.
1908		Pingriff, George Neville, B.A. (Cantab.), The Grammar School, Market Bosworth, Nuneaton
1889		Pingstone, George Arthur, P.O. Box 445, Bulawayo, S. Africa
1904		Pinkerton, David John, Dalzell Steel and Iron Works, Motherwell, N.B.
1908		Pinnock, Douglas Robert, A.C.G.I., 31, The Gardens, E. Dulwich, S.E.
1881		Pisani, Orestes Victoriano, 56, Cavendish-road, Balham, S.W.
1903	Trans.	Pitt, Arthur Ernest, Broad View, Chigwell-road, South Woodford, N.E.
1903		Pitt, Harold Russell, 21, Parkview-terrace, Welling
1882		‖Pitt, Theophilus, Highleigh, Sidlesham, Chichester
1899		Pittuck, Frederick Williams, 19, Stratford-grove, Heaton, Newcastle-on-Tyne
1899		Pizey, James Henry, A.R.C.S., F.I.C., 22, Duke's-avenue, Muswell Hill, N.
1893		Platt, Charles, M.D., Ph.D., 3612, Baring-street, Philadelphia, U.S.A.
1899	Trans.	‖Plimmer, Robert Henry Aders, D.Sc. (Lond.), 3, Hall-road, N.W.
1907		Pochin, Harold, M.A. (Cantab.), The Grammar School, Wolverhampton.
1888		Pollard, Frederick Ernest, F.I.C., 14, Old Hall-street, Hertford
1898	Trans.	Pollard, William, M.A. (Cantab.), D.Sc. (Tübingen), F.I.C., The Museum, Jermyn-street, S.W.
1903		‖Pollard, William Branch, B.A. (Cantab.), Laboratory-buildings, Public-works-gardens, Cairo, Egypt
1902		Pollitt, George Paton, B.Sc. (Vict.), Ph.D. (Bâle), Winnington, Northwich, Cheshire
1901		Pollitt, James Charles Tomlin, 7, Grosvenor-road, Handsworth, Birmingham
1896		Pollitt, Robert Barnabas, F.I.C., Dinamita, *via* Noé, Durango, Mexico
1894	Trans.	‖Pollok, James Holms, D.Sc. (Glas.), Royal College of Science, Stephen's-green, Dublin
1903		Pond, George Gilbert, Prof., M.A. and Ph.D. (Amherst), State College, Pennsylvania, U.S.A.
1890		Pond, James Alexander, Auckland, New Zealand
1899		Ponthieu, Georges, 25, St. Jean Baptiste, Montreal, Canada
1909	Trans.	Pope, Frank George, 28, Alcester-crescent, Upper Clapton, N.E.
1898	Trans.	Pope, Thomas Henry, B.Sc. (Birm.), A.C.G.I., F.I.C., Brewing School, The University, Birmingham

Date of Election.			
1891	Trans.	C. 1900-2	†‖Pope, William Jackson, Prof., M.A. (Cantab.), M.Sc. (Manc.), F.R.S., F.C.G.I., F.I.C., Chemical Laboratories, The University, and Holmesdale, Brooklands-avenue, Cambridge
1906			Porritt, Benjamin Dawson, B.Sc. (Lond.), A.I.C., c/o Miss Laing, 62, Queen-street, Edinburgh
1903			Porter, Robert James, B.Sc. (Lond.), 11, Arlington-street, Hull
1884	Proc.		‖Porter, Thomas Cunningham, M.A. and D.Sc. (Oxon.), Upton-park, Slough ; and Eton College, Windsor
1904			‖Porter, Thomas Linton Daniel, B.Sc. (Lond.), 161, Downsell-road, Stratford New Town, E.
1883			Potter, Charles Edward, c/o Messrs. Tate and Sons, Love-lane Sugar Refinery, Liverpool
1896			Potts, Henry William, Hawkesbury Agricultural College, Richmond, N.S.W.
1895			Powell, Harry James, 125, Thurlow-park-road, Dulwich, S.E.
1884			‖Power, Francis Reginald, The Royal Mint, Melbourne, Australia
1896	Trans.		Power, Frederick Belding, Ph.D. (Strassburg), Hon. LL.D. (Wisconsin), 6, King-street, Snow-hill, E.C.
1908			Power, George O'Brien, Assistant Opium Agent, Basti, B.N.W. Railway, India
1902			Powney, William Edmund Francis, A.I.C., 17, Nightingale-lane, Hornsey, N.
1904	Trans.		Prentice, Bertram, Ph.D. (Munich), D.Sc. (Edin.), Royal Technical Institute, Salford
1910			Preston, Knowles, Newhaven, Camden-avenue, Feltham, Middlesex
1902			Přibram, Richard, Hofrat Prof. Dr., Horlgasse 9, Vienna IX., Austria
1882			‖Price, Arthur Faraday, 2503, Broadway, San Francisco, Cal., U.S.A.
1899			Price, Robert Coleman, Prof., The Miller School, P.O., Albemarle Co., Va., U.S.A.
1901	Trans.		Price, Thomas Slater, D.Sc. (Lond. and Birm.), Ph.D. (Leipzig), F.I.C., Chemical Department, Municipal Technical College, Suffolk-street, Birmingham
1889			‖Priestley, Charles William, B.Sc. (Lond.), A.R.C.S., Richmond Lodge, Torquay
1871	Trans.		‖Procter, Henry Richardson, Prof., Hon. M.Sc. (Leeds), F.I.C., The University, Leeds ; and Rowangarth, Ben Rhydding, viâ Leeds
1889	Trans.		Proctor, Charles, F.I.C., 118, Grosvenor-road, Westminster, S.W.
1909			Proud, Charles, 12, Chancellor-road, Southend-on-Sea
1896	Proc.		Proude, James, c/o John Turner, Esq., Providence Soap and Oil Works, Halifax
1897			Pullar, Herbert Spindler, Pullar's Dye Works, Perth, N.B.

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† Longstaff Medallist 1903.

Date of Election.			
1882			‖Pullar, Rufus Daniell, Brahan, Perth, N.B.
1902			Puntan, Herbert Harding Cruikshank, Borough Analyst's Office, London-chambers, Durban, Natal, S. Africa
1875	Trans.	C 1888-92 V.P.1899-1902	Purdie, Thomas, Emeritus Prof., Ph.D. (Würzburg), Hon. LL.D.(Aberd.), B.Sc. (Lond.), F.R.S., A.R.S.M., F.I.C., The University, St. Andrews
1901	Trans.		Purvis, John Edward, M.A. (Cantab.), A.R.C.S.I., F.I.C., University Chemical Laboratory, Cambridge
1906			Pye, Thomas Ebenezer, Clovelly, Chichester, Sussex
1886			Pyke, Lazarus Simon Magnus, Assoc.M.Inst.C.E., M.Inst.E.E., 10, Westbourne-terrace, Hyde Park, W.
1905	Trans.		Pyman, Frank Lee, D.Sc. (Vict.), Ph.D. (Bâle), Carlee, Selborne-road, Sidcup, S.O., Kent
1905			Quant, Ernest, 2, Park-crescent, Torquay
1868			Quibell, Oliver, Shalem Lodge, Newark
1894			Quinn, Gerald Grattan, A.R.C.S., 6, Glenroyd, Spotland, Rochdale
1902			Ralphs, Edwin, Queen's College, Hong Kong
1897			Ralston, William, B.Sc. (Lond.), F.I.C., 149, Onslow-drive, Dennistoun, Glasgow
1892	Trans.		‖Ramage, Hugh, M.A. (Cantab.), A.R.C.S.I., F.I.C., Ridgemont, Carrow-hill, Norwich
1873	Trans.	C. 1886-9 V.P.92-5, 1897-1900 F.S.1902-1907 P. 1907-9	†‖Ramsay, Sir William, K.C.B., Ph.D. (Tübingen), Hon. LL.D. (Glas.), Hon. Sc.D. (Dub. and Cantab.), Hon. D.Sc. (Oxon., L'pool and Columbia), Hon. LL.D. (Birm.), F.R.S., F.I.C., University College, W.C.; and 19, Chester-terrace, Regent's Park, N.W.
1901			Ramsden, William Cecil, 107, Moyne-road, Rathmines, Dublin
1902			Ramshaw, Walter, Oakleigh, Cann-road, Shaftesbury, Dorset
1885			Ranken, Charles, Stockton-road, Sunderland
1889			Ransom, Francis, The Chilterns, Hitchin
1898			Ratcliffe, Walter, 21, Mawdsley-street, Bolton
1905			Ratcliffe, William Henry, B.Sc. (Lond.), 46, Glenhouse-road, Eltham Park, S.E.
1910			Rattey, Clifford Clare, 12, Princess-avenue, Sedgley-Park, Manchester
1910			Rau, Malur Srinivasa, M.A., M.D. and B.Sc. (Edin.), D.P.H. (Cantab.), The Chemical Laboratory and Bacteriological Institute, Bangalore, Mysore, S. India
1906			Rawles, Walter Hansen, 81, Lewisham High-road, S.E.
1880			‖Rawson, Christopher, F.I.C., Battenberg-avenue, Leicester

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† Longstaff Medallist, 1897.

Date of Election.			
1884	Trans.		‖Rawson, Sidney George, D.Sc. (Lond.), F.I.C., Battersea Polytechnic, Battersea, S.W.
1898			Ray, John Armstedt, jun., B.A. (Dub.), 15, Nassau-street, Dublin
1908			Ray, Haradhan, M.A. (Calcutta), 9, Protap Chatterjee's-lane, College-street, Calcutta, India
1902	Trans.		Rây, Prafulla Chandra, Prof., Presidency College, Calcutta
1889	Trans.		‖Read, Arthur Avery, Prof., M.Met. (Sheffield), F.I.C., University College, Newport-road, Cardiff
1895			Read, Edwin James, B.A. (Cantab.), F.I.C., Dart Villa, Victoria-avenue, Westgate-on-Sea
1899	Trans.		Read, Harold McLean, 19, Baronsmead-road, Castlenau, Barnes, S.W.
1900			Readman, James Fraser, 8, Park-avenue, Glasgow
1908			Readwin, William, Elmleigh, Morley, Leeds
1910			Reddie, John Alexander, 3, Spring-gardens, Bradford
1890			Redding, Richard James, 29, Isla-road, Plumstead, Kent
1906	Proc.		Redgrove, Herbert Stanley, B.Sc. (Lond.), 138, Tottenham-court-road, W.
1892			Redman, Henry Ramsden, 60, Nelson-road, Gillingham, Kent
1866		{C.1891-2 1910- }	Redwood, Sir Boverton, Hon. D.Sc. (Ohio), F.R.S.E., F.I.C., 4, Bishopsgate-street-within, E.C.
1889			Redwood, Robert, 4, Bishopsgate-street-within, E.C.
1886	Trans.		Rée, Alfred, Ph.D. (Berne), 15, Mauldeth-road, Withington, Manchester
1882	Proc.		Reed, Lester, F.I.C., Hyrsthof, 19, South-park-hill-road, South Croydon
1910	Trans.		Reed, Walter William, M.Sc. (Wales), A.I.C., 28, South-parade, Huddersfield
1910			Rees, John James Beaumont, B.Sc. (Lond.), Johannesburg College, Johannesburg, S. Africa
1909			Regan, Colston James, B.Sc. (Lond.), 14, Penerley-road, Catford, S.E.
1880			‖Regester, William, 13, Corfton-road, Ealing, W.
1897			Reid, Alexander Ferguson, Bonshaw, Stewarton, N.B.
1893			Reid, Thomas Anderson, Crosby, Isle of Man
1881			‖Reid, Walter Francis, F.I.C., Fieldside, Addlestone, Surrey
1907	Trans.		Remfry, Frederic George Percy, B.A. (Cantab.), D.Sc. (Geneva), Croft Lodge, Sandhurst Road, Sidcup, S.O., Kent
1897			Remington, John Stewart, Aynsome, Grange-over-Sands, Carnforth, Lancs.
1886			Remington, Joseph Price, Prof., 1832, Pine-street, Philadelphia, U.S.A.
1908			Rennie, Alexander, P.O. Box 703, Johannesburg, Transvaal, S. Africa

Date of Election.			
1879	Trans.		Rennie, Edward Henry, Prof., D.Sc. (Lond.), F.I.C., T University, Adelaide, S. Australia
1898	Proc.		Renwick, Frank Forster, Norland House, Avenue-road, Bren wood, Essex
1909			Resker, Herbert Charles, B.A. (Cantab.), The Sugar Work Cossipore, India
1902	Trans.		Revis, Cecil, 5, Carlton-villas, Station-road, Barnes, S.W.
1873	Trans.	V.P. 1881-4, 89-92, 97-1900- P. 1901-1903.	Reynolds, James Emerson, Prof., Hon. Sc.D. and Hon. M. (Dub.), M.R.C.P. (Ireland), L.R.C.P. and S. (Edin.), F.R.S 3, Inverness-gardens, Kensington, W.
1898	Trans.		Reynolds, William Colebrook, B.Sc. (Lond.), Meersbrook, Esse road, Dartford, Kent
1908	Trans.		Rhead, Ezra Lobb, F.I.C., Stonycroft, Polygon-avenue, Leven hulme, Manchester
1907			Rhodes, Percy Joseph, Bridge House, Church, Lancs.
1898	Trans.		Rich, Edward Milton, 18, Manor-road, Forest Hill, S.E.
1903			Rich, Stiles William George, c/o Messrs. Thomason Chater, Ltd Stanley-street, South Brisbane, Queensland
1889			Richards, Duncan Taylor, 57, Osborne-avenue, Westoe-lan South Shields
1889			‖Richards, Edgar, 60, Ayrault-street, Newport, Rhode Islan U.S.A.
1908			Richards, Francis Edward, B.Sc. (Lond.), A.R.C.S., Coun Secondary School, Redruth
1905			Richards, Frederick George, 21, Dutton-street, Manchester
1889			‖Richards, Percy Andrew Ellis, F.I.C., Thurn Lodge, Upp Richmond-road, Roehampton, S.W.; and Charing Cro Hospital Medical School, W.C.
1886			Richards, William, B.Sc. (Lond.), 58, Thrale-road, S.W.
1885	Trans.		‖Richardson, Arthur, The Central Hindu College, Benare N.W.P., India
1888	Trans.		‖Richardson, Clifford, A.B. (Harvard), M. Am. Soc. C.E., 3 Church-street, New York City, U.S.A.
1906			‖Richardson, Frederic Ion, B.A. (Cantab.), 149, Highbury-hill, N
1883			Richardson, Frederic William, F.I.C., County Analyst's Offic Bradford
1888			Richardson, Hubert Naylor Bardsley, B.A. (Cantab.), 10, Fria lane, Leicester
1906			Richardson, Lawrence George, c/o Mrs. Young, Newtown-view Glenpatrick-road, Elderslie, Johnstone, N.B.
1892			Richardson, Reginald Edensor Stanley, 10, Friar-lane, Leicester
1887	Trans.		Richmond, Henry Droop, F.I.C., Mex, Avondale-avenue, Wood side Park, N.

Date of Election.			
1894			Riddick, David Gibson, Stores Department, G.E.R., Stratford, E.
1882	Trans.		‖Rideal, Samuel, D.Sc. (Lond.), F.I.C., 28, Victoria-street, Westminster, S.W.
1882	Trans.		Ridsdale, Charles Henry, F.I.C., Ravenscroft, Roman-road, Linthorpe, Middlesbrough
1888			Rigby, John Samuel, 26, Bagot-street, Wavertree, Liverpool
1905			Rigby, Thomas, c/o Messrs. Crossley Bros., Ltd., Openshaw, Manchester
1898			Rigg, Gilbert, c/o The New Jersey Zinc Co., Palmerton, Carbon Co., Pa., U.S.A.
1851	Trans.	C. 1878-80	Riley, Edward, F.I.C., 14A, Finsbury-square, E.C.
1904			Riley, Louis John Eczekiel, F.I.C., 8, Newton-road, W.
1900			Riley, Walter Alfred, 207, Earlham-road, Norwich
1893			Rintoul, William, F.I.C., Lauriston, Ardrossan, Ayrshire
1909			Ritchings, Walter, M.Sc. (Manc.), 21, Rosehill-road, Burnley
1907			Rixon, Frederic William, M.Sc. (Vict.), Ph.D. (Giessen), 93, Cromwell-road, Bristol
1908			Roach, William Frothingham, M.D. and M.S. (Montreal), L.A.H. (Dub.), Epe, viâ Lagos, Southern Nigeria, Africa
1902			Roast, Harold James, 43, Rielle-street, Cote St. Paul, Quebec, Canada
1893			Robbins, James Henry, B.Sc. (Lond.), 4, Selborne-road, Ilford, Essex
1883			‖Roberts, Frederick George Adair, Chemical Works, Carpenter's-road, Stratford, E.
1899			Roberts, James, jun., 605, Great Western-road, Hillhead, Glasgow
1876			Roberts, Martin Fenn, Mabshill, Epsom
1894			Roberts, Thomas John, Ingleside, Park-road, Huyton, near Liverpool
1894			Robertson, Archibald Blair, 39, Westbury-road, Bristol
1904			Robertson, Franklin Ernest, Gloster House, Harders-road, Peckham, S.E.
1903	Trans.		Robertson, Philip Wilfred, M.A. (N.Z.), Rangoon College, Rangoon, Lower Burma, India
1907	Trans.		Robertson, Robert, M.A. and D.Sc. (St. Andrews), F.I.C., Research Department, Royal Arsenal, Woolwich, S.E. ; and 29, Charlton-road, Blackheath, S.E.
1901	Trans.		Robertson, William, 21, Worfield-street, Battersea Park, S.W.
1889			Robins, Harry Hollis, c/o Messrs. Southwell and Co., Dockhead, S.E.
1903			Robinson, Archibald Louis, Surgeon, R.N., M.A. and M.B. (Dub.), H.M.S. Dreadnought, Home Fleet

Date of Election.			
1909	Trans.		Robinson, Frederic William, B Sc. (L'pool), Grove Hous Farnworth, Widnes
1896			Robinson, Henry Fishwick, M.Sc. (Vict.), 2, Richmond-stre Droylsden-road, Newton Heath, Manchester
1882	Trans.		‖Robinson, Henry Haliburton, M.A. (Oxon.), F.I.C., 4 Penywern-road, Earls Court, S.W.
1895			Robinson, Herbert Lewin, The Plating Co., 10, Kirby-stre Hatton-garden, E.C.
1907			Robinson, John, Agricultural College, Aspatria, Cumberland
1906			Robinson, Reginald Ernest, B.A. (Cantab.), The Villas, Stol on-Trent
1909	Trans.		Robinson, Robert, M.Sc. (Manc.), Field House, Chesterfield
1904			Rodger, Robert, 54, Rostrevor-road, S.W.
1898			Rofe, Henry John, M.A. (Oxon.), 8, Victoria-street, Westminst S.W.
1883			Rogers, Arthur William, Tadcaster Tower Brewery Co., Tadcast
1884			Rogers, Francis Murray, 21, Burma-road, Stoke Newington, N
1905			Rogers, Harold Rudolf, M.A. (Oxon.), 38, King-street, Newcast Staffs.
1909			Rogers, Herbert, Stenning House, Cobwell-road, Retford, Nott
1903			Rogers, William David, B.Sc. (Lond.), A.R.C.S., F.I.C., 6 Roseberry-road, Smethwick, B.O., Staffs.
1906	Trans.		Rogerson, Harold, M.Sc. (Manc.), 6, King-street, Snow Hill, E.
1894			Rolfe, John F., 50, South-street, Greenwich, S.E.
1903			Roose, Fitzroy Owen Jonathan, Assoc.Inst.E.E., c/o Cordo Light, Power and Traction Co., Ltd., Cordolia, Argenti Republic, S. America
1855	Trans.	C. 1860-4, 1871-3 V.P. 73-5, 1877-80 P. 80-2	Roscoe, Sir Henry Enfield, P.C., B.A. (Lond.), D.C.L., (Oxon LL.D. (Cantab., Dub., Glas., Montreal, Aberd.), Ph.D. a Hon. M.D. (Heidelberg), Hon. D.Sc. (Vict.), F.R.S., 1 Bramham-gardens, South Kensington, S.W.
1910			Rose, John George, Government Analytical Laboratory, Ca Town, S. Africa
1891	Trans.	C. 1897-8	‖Rose, Thomas Kirke, D.Sc. (Lond.), 6, Royal Mint, E.
1896	Trans.		Rosenheim, Otto, Ph.D. (Würzburg), 68, Belsize-park-gardens, N.
1894			Ross, Arthur, F.I.C., 1, Glengall-road, Old Kent-road, S.E.
1905			Ross, Frederick Wilson Montrose, 21, Soho-square, W.
1870			Ross, Lewis Buttle, Driffield, Yorks.
1896			Ross, Raymond St. George, F.I.C., Public Analyst's Office, Burnl
1902			Ross, William Charles, Capt., I.M.S., M.B., Ch.B. and D.P. (Edin.), Deputy Sanitary Commissioner, Bankipore, E.I. Bengal, India
1891	Proc		Rossiter, Edmund Charles, F.I.C., 4, Park-road, West Smethwi Birmingham

Date of Election.			
1892			Rothwell, Charles Frederick Seymour, Beech Croft, Mobberley, Knutsford
1904			Rouillard, Marie Jean Louis Ernest, B.Sc. (Edin.), Malvern, Natal, S. Africa
1899			Roundell, Christopher Foulis, Lieut., B.A. (Oxon.), Guards' Club, Pall Mall, S.W.
1905			Rowley, Henry, M.Inst.E.E., 81, Barrack-street, Perth, Western Australia
1906			Rowsell, Philip Foale, Nutbrook, Exmouth, S. Devon
1900			Roy, Mathura Goolab, 74, Iyah Mudali-street, Chintadrepettah, Madras, India
1899			Royal-Dawson, Henry, c/o Messrs. Peyton and Son, Lister-street, Birmingham; and 6, Wimbourne-road, Edgbaston, Birmingham
1901			Royle, Charles Leonard, 1, Wigram-road, Wanstead, N.E.
1905			Royle, Harold Marmion, Store House, Gas Works, Beckton, North Woolwich
1909			Rudolf, Norman Scott, Prof., M.Sc. (Vict. and L'pool), F.I.C., Indian Institute of Science, Bangalore, India
1872	Trans.		Ruffle, John, F.I.C., Musley, Ware, Herts.
1895			Rugginz, William Augustus, Beaulieu, Derby-road, Woodford, N.E.
1889	Trans.	C. 1903 05	Ruhemann, Siegfried, M.A. (Cantab.), Ph.D. (Berlin), Gonville and Caius College, Cambridge
1883			Rumble, Charles, F.I.C., 154, Valley-road, Streatham, S.W.
1908			Runeckles, Arthur Robert, B.Sc. (Lond.), A.C.G.I., 68, Kyrle-road, New Wandsworth, S.W.
1890			‖Russell, Edward, B.Sc. (Lond.), F.I.C., 18, Woodstock-road, Redland-green, Bristol
1898	Trans.		Russell, Edward John, D.Sc. (Lond.), Lawes Agricultural Trust, Rothamsted Experimental Station, Harpenden, Herts.
1901			Russell, James Bertram, B.Sc. (Lond.), Colyton, Hill-road, Weston-super-Mare
1910			Russell, John, B.A. (Oxon.), Oaklands, Carsick-hill, Tom-lane, Sheffield
1908			Rutter, Clement Thomas, 8, Norwood-view, Halfacre-road, Hanwell, W.
1896			Rutter, Thomas Francis, B.Sc. (Lond.), Ph.D. (Leipzig), Newcastle-under-Lyme
1894			Ryce, George, B.A. (R.U.I.), Irish Agricultural Offices of the Potash Syndicate, 50, Essex-street, Dublin
1901	Trans.		Ryffel, John Henry, M.A. (Cantab.), B.Sc. (Lond.), F.I.C., 10, Grasmere-road, Muswell Hill, N.

Date of Election.		
1909		Sabherwal, Pindi Das, University College, Reading
1888		‖Sach, Albert John, Technical College, Goulburn, N.S.W.
1868		Sadler, Sir Samuel Alexander, Col., Cleveland Chemical Works Middlesbrough
1896		Sage, Charles Edward, F.I.C., c/o W. C. Nickels, Esq., 41, Cheapside, E.C.
1909	Trans.	Sageman, Philip John, Government Laboratory, Clements Inn passage, Strand, W.C.
1907		Sahni, Ruchi Ram, M.A., Government College, Lahore, India
1879	Trans.	‖Sakurai, Joji, Prof., Science College, Imperial University, Tokio Japan
1880		Salamon, Alfred Gordon, A.R.S.M., F.I.C., 1, Fenchurch avenue, E.C.
1908		Salamon, Maurice Salamon, 64, Oxford-gardens, N. Kensington, W.
1906		Salmon, Frederick John, c/o Government Survey Department Colombo, Ceylon
1876		‖Salomons, Sir David Lionel, Bart., M.A. (Cantab.), Assoc Inst.C.E., J.P., D.L., Broomhill, Tunbridge Wells; an 49, Grosvenor-street, W.
1863		‖Salt, Henry, M.D. and C.M. (Edin.), Inglewood, Grea Malvern
1871		‖Salter, Mortyn John, F.I.C., Bank House, Mickleton, S.O., Glos
1859		‖Salter, Thomas William, 193, Priory-road, West-hill, Hastings
1907	Trans.	Salway, Arthur Henry, B.Sc. (Lond.), Ph.D. (Leipzig), 51 Goodmayes-avenue, Goodmayes, near Ilford, Essex
1902		Sampson, John William, 4, Adelaide Road, Brockley, S.E.
1882		Samuel, William Cobden, Elmdale, 66, Croxted-road, West Du wich, S.E.
1909		San U, Maung, Chemical Examiner's Office, Rangoon, Burma
1898	Trans.	‖Sand, Henry Julius Salomon, Ph.D. (Zürich), D.Sc. (Birm University College, Nottingham
1870		‖Sandberg, Christer Peter, Palace-chambers, 9, Bridge-street Westminster, S.W.
1900	Proc.	Sanders, James McConnell, c/o Direccion General de Aduanas Mexico
1904		Sanders, Percy Richard, West Cliffe, Seaford, Sussex
1888		Sanderson, John, F.I.C., c/o Messrs. B. S. Cohen, Ltd., 15, Clerkenwell-close, E.C.
1882		Sanford, Percy Gerald, F.I.C., 14, Wellington-road, West Croydo
1890		Saniter, Ernest Henry, Strafford Villa, Moorgate, Rotherham
1891		Sanyal, Abhayacharan, Prof., M.A. (Calcutta), Queen's College Benares, N.W.P., India
1892		Sarbadhicary, Satya-prasad, 1, College-street, Calcutta

Date of Election.			
1900			Sargeant, Fred Pilkington, College of Pharmacy, Clarendon-road, Leeds
1907			Saunders, George Joseph, B.E. (Sydney), School of Mines, Charters Towers, Queensland, Australia
1886			Saunders, William, Prof., Experimental Farm, Ottawa, Canada
1908			Saunderson, William, B.Sc. (Lond.), Armidale School, Armidale, N.S.W..
1909			‖Sawbridge, Bartle Frere, B.A. (Oxon.), A.I.C., Thelnetham Rectory, Diss
1898			Sayer, Harold Charles, 51, Highfield-road, Dartford
1890			Sayers, William Charles, 63, High-street, Lewisham, S.E.
1885			‖Scammell, Luther Robert, c/o Messrs. F. H. Faulding & Co., 54, King William-street, Adelaide, S. Australia
1877			Scarf, Isaac Sydney, F.I.C., City of London College, White-street, Moorfields, E.C.; and 75, Oxford-road, Canonbury, N.
1897			Scargill, Lionel Walter Kennedy, M.A. (Oxon.), 22, Cambridge-street, Eccleston-square, S.W.
1893	Trans.		Schidrowitz, Philip, Ph.D. (Berne), 57, Chancery-lane, W.C.
1888			‖Schieffelin, William Jay, Ph.B. (Columbia), 840, Southern-boulevard, New York, U.S.A.
1907			Schlinger, Charles, B.Sc. (Lond.), Acadia House, 273, Camden-road, N.
1905			Schnurmann, Harry Nestor-, Berrington, Brondesbury Park, N.W.
1907			Schober, William Bush, A.M. and B.Sc. (Annapolis), Ph.D. (Johns Hopkins), Lehigh University, South Bethlehem, Pa., U.S.A.
1892			‖Schofield, James Alexander, A.R.S.M., F.I.C., The University, Sydney, N.S.W.
1903			Scholefield, Alfred Henry, B.A. and B.Sc. (Lond.), 57, The Avenue, Leigh, Lancs.
1905	Trans.		Scholefield, Fred., M.Sc. (Vict.), B.Sc. (Lond. and Leeds), A.I.C., c/o Messrs. R. P. Lawson & Sons, Britannia Mills, Hulme-hall-road, Hulme, Manchester
1902			Scholes, William, Mount Sion, Radcliffe, Lancs.
1899	Trans.		Schryver, Samuel Barnett, D.Sc. (Lond.), Ph.D. (Leipzig), 48, Overstrand Mansions, Battersea Park, S.W.
1909			Schulten, J. H. Charles, Ph.D. (Erlangen), P.O. Box 279, 4, Pollock-street, Calcutta, India
1896			Scotland, Peter Bain, c/o The Arizona Copper Co., Ltd., Metcalf Mines, Clifton, Arizona, U.S.A.
1879	Trans.	C. 1897-9 S. 1899-1904 T. 1904-	‖Scott, Alexander, M.A. and Sc.D. (Cantab.), D.Sc. (Edin.), F.R.S., F.I.C., Davy-Faraday Research Laboratory, 20, Albemarle-street, W.; and 13, Neville-court, Abbey-road, N.W.

Date of Election.			
1908			Scott, Andrew Laidlaw, F.I.C., Royal Gunpowder Factory Waltham Abbey, Essex
1890			Scott, Ernest George, 2, Talbot-court, Gracechurch-street, E.C
1901			Scott, George Charlton, c/o Messrs. Burn & Co., Ltd., Raneegunge, Bengal, India
1905			Scott, John Irwin, M.A. (Oxon.), Deacon's School, Peterboroug
1906			Scouller, Walter Daly, B.Sc. (Vict.), Chester Corporation Sewag Purification Works, Chester
1883	Proc.		Scudder, Frank, F.I.C., 44, Mosley-street, Manchester
1906			Seaber, Willie Macro, B.Sc. (Lond.), A.I.C., Firdale, Sheen-lan East Sheen, S.W.
1896			Seabrooke, Herbert Cecil, F.I.C., Black Ash, Grays, Essex
1891			Searl, Albert, Montreux, Victoria-road, Sidcup, S.O., Kent
1890			Seaton, Edward Cox, M.D. and F.R.C.P. (Lond.), M.R.C.S. (Eng. F.I.C., 93, St. George's-square, S.W.
1905			Seaton, William Dunham, 40, Argyle-road, Ilford, Essex
1908			Seelhorst, William, c/o Eastern Smelting Co., Ltd., Penan Straits Settlements
1909			Segaller, David, B.Sc. (Lond.), A.R.C.S., 2, Cannon Hil terrace, Kingston-road, Merton Park, S.W.
1898			Seligman, Richard, Ph.D. (Heidelberg), A.C.G.I., Oakwoo Oxshott-road, Leatherhead
1892	Trans.	C. 1905-09	Sell, William James, M.A. and Sc.D., (Cantab.), F.R.S., F.I.C University Chemical Laboratory, Pembroke-street, Cambridge
1875			Sellon, John Scudamore, 78, Hatton-garden, E.C.
1910			Sen, Aswini Kumar, B.A. (Calcutta), B.Sc. (Vict.), The Beng Luxmi Mills, Serampore, near Calcutta, India
1906			Sen, Gopal Chandra, M.A. (Calcutta), Bengal Technical I stitute, 92, Upper Circular-road, Calcutta, India
1904	Trans.		Sen, Jatindranâth, M.A. (Calcutta), Agricultural Researc Institute, Pusa, Bengal, India
1875	Trans.		‖Senier, Alfred, Prof., Hon. D.Sc. (R.U.I.), M.D. (Mich.), Ph.I (Berlin), F.I.C., University College, and Gurthard, Galwa Ireland
1906			Senior, John, 135, Eton-road, Ilford, E.
1903	Trans.		Senter, George, D.Sc. (Lond.), Ph.D. (Leipzig), Chemical Labo atory, St. Mary's Hospital Medical School, Paddington, W.
1896			Severn, Walter Dalrymple, A.R.C.S., Public Health Laborator Cape Town, S. Africa
1870	Trans.		Seward, Henry, c/o Messrs. J. B. Freeman, Sons, and Co Wandle Colour Works, Wandsworth, S.W.
1907			Sewell, William George, B.Sc. (Lond.), Bournemouth Schoo Bournemouth

Date of Election.		
1874		‖Sexton, Alexander Humboldt, Prof., F.I.C., F.R.S.E., c/o The Librarian, The Technical College, 204, George-street, Glasgow
1895	Trans.	Seyler, Clarence Arthur, B.Sc. (Lond.), F.I.C., The Technical Institute, Nelson-terrace, Swansea
1904		Shacklady, Thomas George, Curhar, Cliffe-at-Hoo, Rochester
1880		Shadwell, John Emilius Lancelot, F.I.C., Milton House, Bathwick-hill, Bath
1874		Sharman, William, 186, Mare-street, Hackney, N.E.
1885		Sharp, James, Shirley Manor, Wyke, near Bradford
1895		Sharrott, Thomas Chilwell, B.A. (Dub.), A.R.C.S., F.I.C., 60, Albert-road, Tamworth
1895	Trans.	‖Shaw, George Elliott, B.Sc. (Lond.), F.I.C., Mungpoo P.O., Sonada, D.H. Railway, Bengal, India
1908		Shaw, William Bayliss, B.A. (Oxon.), Lonsdale House, Walsall
1887		Sheard, John Tomlinson, Birley Carr, Sheffield
1899		Shelbourn, Edward Thomas, F.I.C., 40, Craven-street, Strand, W.C.
1904	Proc.	Shelton, Henry Stanley, B.Sc. (Lond.), Silvermead, Ashford, Middlesex
1897		Shenton, James Porter, 37, Torbay-road, Chorlton-cum-Hardy, near Manchester
1907	Trans.	Shepheard, Frederick George, B.Sc. (Lond.), A.R.C.S., A.I.C., 5, University-road, Galway, Ireland
1899	Trans.	Shepheard, William Frederick John, 12, Bridge-street-row, Chester
1906		Shepherd, Arthur Burton, B.Sc. (Vict.), F.I.C., c/o The British Oil and Cake Mills, Ltd., Copenhagen Mill, Limehouse, E.
1874		‖Shepherd, Harcourt Henry Benjamin, F.I.C., Northcote, Mount Pleasant-lane, Upper Clapton, N.E.
1899		Shepherd, John William, B.Sc. (Lond.), 3, Fairlawn-road, Wimbledon, S.W.
1901	Trans.	Sheppard, Samuel Edward, D.Sc. (Lond.), 100, Bromley-road, Catford, S.E.
1901		Shepperson, William, The Pryors, East Heath-road, Hampstead, N.W.
1891	Trans.	‖Shields, John, D.Sc. (Edin.), Ph.D. (Strassburg), F.I.C., 4, Stanley-gardens, Cricklewood, N.W.
1908		Shilstone, Herbert Maxwell, B.Sc. (Tulane), c/o Messrs. Penick and Ford, Ltd., 416, South Front-street, New Orleans, U.S.A.
1896		Shimomura, Kotaro, Prof., Shinkarasumara, Kajinguchi Sagaru, Kyoto, Japan
1894		Shorthouse, Herbert Stephen, 144, Edmund-street, Birmingham
1906		Shrimpton, John Kirby, Redshaw House, Ripon
1904		Shrubsole, Alfred, 18, Forest-drive-west, Leytonstone, N.E.

Date of Election.		
1886		Shutt, Frank Thomas, M.A. (Toronto), F.I.C., Experimental Farm, Ottawa, Canada
1890		Shuttlewood, Willis Brewin, 78, Whitehall-park, Hornsey-lane, Highgate, N.
1894		Shuttleworth, Edward Buckingham, Prof., 220, Sherborne-street, Toronto, Canada
1904		Siau, Raymond Louis, 15, Merridale-lane, Wolverhampton
1903		Sibley, Samuel Edward, Tottenham, Warren-road, Marrickville, Sydney, N.S.W.
1889		Sibson, Alfred Edward, 19, Carlingford-road, Hampstead, N.W.
1903		Siddle, George, Middleton-one-row, S.O., Co. Durham
1902	Trans.	‖Sidgwick, Nevil Vincent, M.A. (Oxon.), D.Sc. (Tübingen), Lincoln College, Oxford
1900	Trans.	Silberrad, Oswald, Ph.D. (Würzburg), Buckhurst Hill, S.O., Essex
1886		Silvester, Harry, Hon. B.Sc. (Birm.), F.I.C., 78, Holy Head-road, Handsworth, Birmingham
1906		Sime, Allan, Box 19, Port Limon, Costa Rica, S. America
1899	Trans.	Simmonds, Charles, B.Sc. (Lond.), Airdrie, 61, Cottenham-park-road, Cottenham-park, Wimbledon, S.W.
1889		Simmonds, Henry, Engineer's Office, Gas Works, and Elton View House, Bury, Lancs.
1887		‖Simmons, Leonard Owen, 45, Wavertree-rd., Streatham Hill, S.W.
1905		Simmons, William Herbert, B.Sc. (Lond.), Oakleigh, Stoke Newington Common, N.
1895		Simons, Albert Joseph, c/o M. Simons, Esq., 31, Little Britain, E.C.
1906	Trans.	Simonsen, John Lionel, Prof., D.Sc. (Manc.), Presidency College, Madras, India
1896		Simpson, Aitken Megget, 27, York-grove, Queen's-rd., Peckham, S.E.
1902		Simpson, Duncan Ivan Rennard, c/o Bucks Reef Gold Mine, Colleen Bawn Siding, Southern Rhodesia, S. Africa
1897		Simpson, Edward Sydney, B.E. (Sydney), Geological Survey Laboratory, Museum-street, Perth, Western Australia
1886	Proc.	‖Simpson, William Selby, F.I.C., The Gables, Cannon-hill, Southgate, N.
1910		Sinclair, St. Clair Overbeek, M.A. (Cape of Good Hope), Government Analytical Laboratory, Grahamstown, Cape Colony, S. Africa
1902	Proc.	Sindall, Robert Walter, 201, Wellmeadow-road, Catford, S.E.
1889		Singer, Ignatius, 3, Parkfield-road, Manningham, Bradford
1908		Singh, Puran, Acting Imperial Forest Chemist, Dehra Dun, U.P., India
1909		Sinha, Manindra, B.A., St. Xavier's College, 10 and 11, Park-street, Calcutta, India
1902	Proc.	Sinnatt, Frank Sturdy, Glenside, Church-lane, Moston, Manchester

Date of Election.		
1896		‖Sircar, Amrita Lal, 51, Sankaritola, Calcutta, India
1902		Skertchly, William Pearson, F.I.C., 11, Billiter-square, E.C.
1888	Trans.	Skinner, Sidney, M.A. (Cantab.), South Western Polytechnic, Manresa-road, Chelsea, S.W.
1899	Trans.	Skirrow, Frederick William, M.Sc. (Vict.), Ph.D. (Leipzig), The Wynyatts, Morecambe, Lancs.
1892		Skurray, Thomas, United Breweries, Abingdon, Berks.
1910	Trans.	Slade, Roland Edgar, M.Sc. (Vict.), Muspratt Laboratory, The University, Liverpool
1879		Slater, Charles, M.A. and M.B. (Cantab.), M.R.C.S. (Eng.), 81, St. Ermin's-mansions, Westminster, S.W.
1880	Trans.	‖Slater, Harold Humboldt, F.I.C., St. Lawrence, Borstal-road, Rochester, Kent
1903	Trans.	Slator, Arthur, Ph.D. (Leipzig), D.Sc. (Birm.), B.Sc. (Lond.), F.I.C., The Priory, Burton-on-Trent
1878		‖Slatter, George William, A.R.C.S.I., F.I.C., 241, Carlton-terrace, Nab Wood, Shipley, Yorks.
1895		Slocum, Frank Leroy, Ph.D. (Strassburg), 401, South Linden-avenue, E.E., Pittsburg, Pa., U.S.A.
1875		‖Smetham, Alfred, F.I.C., 16, Brunswick-street, Liverpool
1898	Trans.	Smiles, Samuel, D.Sc. (Lond.), University College, Gower-street, W.C.
1883		Smith, Adolphe, 12, Crookham-road, Fulham, S.W.
1890	Trans.	‖Smith, Alexander, Prof., Ph.D. (Munich), B.Sc. (Edin.), University of Chicago, Chicago, Ill., U.S.A.
1901		Smith, Andrew Biggam, c/o M. Armstrong, Esq., P.O. Box 90, Queenstown, Cape Colony, S. Africa
1888		Smith, Angus, F.I.C., 10, Ardgowan-street, W., Greenock, N.B.
1898		Smith, Benjamin Jordan-, 11, Grosvenor-road, Handsworth, Birmingham
1906		Smith, Charles, Knowsley-road, Smithills, Bolton
1903		Smith, Charles Joseph, Sunnydale, Walton New-road, Stockton Heath, near Warrington
1904	Trans.	Smith, Clarence, D.Sc. (Lond.), 28 Chadwick-road, Leytonstone, N.E.
1894	Trans.	Smith, Claude, F.I.C., Barngarth, Cartmel, Carnforth
1884		‖Smith, Edgar Francis, Trelawny, 21, Fairfax-road, Bedford Park, W.
1910		Smith, Ernest William, B.Sc. (Lond.), 20, St. Bevan's-road, Halifax
1906		Smith, Frank, B.Sc. (Vict.), 51, Hilden-street, Haulgh, Bolton
1874		Smith, George, F.I.C., Nobel's Explosives Co., Polmont Station, N.B.
1896		Smith, George Egerton Scott-, F.I.C., 67, Surrey-street, Sheffield

Date of Election.			
1892			‖Smith, George Percy Darnell-, B.Sc. (Lond.), F.I.C., Chie Secretary's Department, Bureau of Microbiology, Sydney, N.S.W.
1890			Smith, Harry Wood, B.Sc. (Vict.), c/o Messrs. John Batt and Co., Ltd., 39, Old Broad-street, E.C.
1896	Trans.		Smith, Henry George, The Technological Museum, Sydney, N.S.W.
1904			Smith, Henry Heron, F.I.C., 76, Plumstead-common-road, Plumstead, Kent
1909	Trans.		Smith, Henry Llewellyn, B.Sc. (Manc.), A.I.C., King's College, Strand, W.C.
1878			Smith, Henry Russell, F.I.C., 1, Aubert-park, Highbury, N.
1900			‖Smith, Herbert Procter, c/o Hawarden Bridge Steel Works, Shotton, Flints.
1901			Smith, James, 80, Ampthill-road, Aigburth, Liverpool
1903			Smith, James Cruickshank, B.Sc. (Aberd.), Holmdene, Colebrook-avenue, West Ealing, W.
1910			Smith, James Harry, 5, Turks-road, Radcliffe, Manchester
1879			‖Smith, John William, 7, Brookfield-street, Roslindale, Boston, Mass., U.S.A.
1902			Smith, Leonard, Hillside, Park-hill-road, Croydon
1901	Trans.		Smith, Norman, D.Sc. (Vict.), The University, Manchester
1902			Smith, Robert Ely Blake, B.Sc. (Lond.), A.I.C., 31, St. John's-road, Putney, S.W.
1897			Smith, Robert Francis Wood, 90, Lower Thames-street, E.C.
1891			Smith, Robert Greig-, D.Sc. (Edin.), M.Sc. (Dun.), Linnean Society's House, Elizabeth Bay, Sydney, N.S.W.
1907			Smith, Robert Harry, Apsley House, Priory-road, Sheffield
1907			Smith, Robert Low, c/o Messrs. Vickers, Sons and Maxim, Ltd., Erith, Kent
1888			Smith, Samuel, Hillsboro', Goddard-avenue, Old Swindon
1907			‖Smith, Sydney William, B.Sc. (Lond.), A.R.S.M., The Royal Mint, E.
1910			Smith, Thomas May, c/o Messrs A. Boake, Roberts & Co., Ltd., Carpenter's-road, Stratford, E.
1866	Trans.		Smith, Watson, F.I.C., 34, Upper-park-road, Haverstock Hill, N.W.
1876			‖Smith, William Alexander, M.A. and M.B. (Oxon.), M.R.C.S. (Eng.), 70, Pembroke-road, Clifton, Bristol
1903			Smith, William Veysey, B.A. (Oxon.), 38, St. Petersburgh-place, W.
1883	Trans.	C. 1896-1900. V.P. 1905-08	‖Smithells, Arthur, Prof., B.Sc. (Lond.), F.R.S., F.I.C., The University, Leeds

Date of Election.		
1873		‖Smyth, John, M.A. (Dub.), M.Inst.C.E., Milltown, Banbridge, Ireland
1908	Trans.	Smythe, John Armstrong, D.Sc. (Dun.), Ph.D. (Göttingen), Armstrong College, Newcastle-on-Tyne
1902		Smythe, John Seabury, B.Sc. (Vict.), Ph.D. (Würzburg), Rantallard, Lance-lane, Wavertree, Liverpool
1887	Trans.	‖Snape, Henry Lloyd, Prof., D.Sc. (Lond.), Ph.D. (Göttingen), F.I.C., Balholm, Lathom-road, Southport
1899	Trans.	Soddy, Frederick, M.A. (Oxon.), F.R.S., Chemical Department, The University, Glasgow
1887		Sohn, Charles Emile, F.I.C., 52, Fore-street, E.C.
1891		Solomon, Frank Oakley, Dauntsey's Agricultural School, West Lavington, Devizes, Wilts.
1908		Sommerfeldt, Ernst, Ph.D. (Göttingen), P.O. Box 279, 4, Pollock-street, Calcutta, India
1906		Sommerville, David, B.A. (R.U.I.), M.D., B.Ch., and D.P.H. (Cantab.), M.R.C.P. (Lond.), 31, Manor House, Marylebone-road, N.W.
1910		Sorabji, Kaikhushroo Bamanji, L.M. and S. (Bombay), Secunderabad, Deccan, India
1893		Sorrell, Henry Thomas, The Eagle Brewery, Wellclose-square, E.
1875		Southall, Alfred, Garrick House, Richmond Hill, Edgbaston
1908		Southcombe, James Edward, M.Sc. (L'pool), 138, Chester-street, Birkenhead
1897	Proc.	Southerden, Frank, B.Sc. (Lond.), F.I.C., Royal Albert Memorial College, Exeter
1910	Trans.	Southgate, Herbert William, B.Sc. (Lond.), 130, Horseferry-road, Westminster, S.W.
1883		Soward, Alfred Walter, 28, Therapia-road, Honor Oak, S.E.
1892		Spackman, Charles, Rosehaugh, Clitheroe, Lancs.
1908		Speed, John Day, Elmdene, Freezywater, Waltham Cross
1905		Speight, William Ewart, Corporation Sewage Works, Deighton, Huddersfield
1883		‖Spencer, Ernest Samuel, 27, Charlton-road, Blackheath, S.E.
1906	Trans.	Spencer, James Frederick, D.Sc. (L'pool), B.Sc. (Vict.), Ph.D. (Breslau), Bedford College for Women, Baker-street, W.
1886		Spencer, Richard, 242, Dalton-road, Barrow-in-Furness
1887		‖Spencer, Walter Shelley, Lyndene, Darley-grove, Farnworth, near Bolton
1894		Spenzer, John George, Prof., M.D. (Ohio), Ph.D. (Strassburg), Ohio Wesleyan University, 1825, East 93rd street, N.E., Cleveland, Ohio, U.S.A.
1904		Spielmann, Percy Edwin, B.Sc. (Lond.), Ph D. (Bâle), A.R.C.S., F.I.C., 21, Cadogan-gardens, S.W.

Date of Election.		
1908		Spiers, Charles Sedgley, Beaudesert, Queensland, Australia
1859	Trans.	‖Spiller, John, F.I.C., 2, St. Mary's-road, Canonbury, N.
1863		‖Spiller, William, F.I.C., 2, Lindfield-gardens, Hampstead, N.W
1885		‖Spottiswoode, William Hugh, Balliol College, Oxford; an 6, Middle New-street, E.C.
1906	Trans.	Sproxton, Foster, B.Sc. (Lond.), Brantham Works, near Manningtree, Essex
1882		‖Squire, Peter Wyatt, 413, Oxford-street, W.
1892		Squires, Alfred James, Greenbank, Coroner's-lane, Farnworth Widnes, Lancs.
1877		Stacey, Henry George, Brunton's Wharf, 671, Commercial-road, E
1899		Stainer, John Ward, 103, Cheriton-road, Folkestone
1879	Trans.	‖Stallard, George, M.A. (Oxon.), Horton-crescent, Rugby
1910		Stanford, Spencer Boyd Cortis-, St. Margaret's, Bishopbriggs Glasgow
1904		Stanger, Reginald Harry Hursthouse, Chemical Laboratory an Testing Works, 2, Broadway, Westminster, S.W.
1902		Stanger, William Charles South, Ambleside, Corder-road Ipswich
1887		‖Stansell, Lionel William, F.I.C., 7, Albion-place, Maidstone, Ken
1895		‖Stansfield, Alfred, D.Sc. (Lond.), McGill University, Montreal Canada
1902		Stansfield, Edgar, M.Sc. (Vict.), Macdonald Chemistry an Mining Building, McGill University, Montreal, Canada
1899		Stansfield, Samuel, B.Sc. (Vict.), 2, Park-road, Batley, Yorks.
1900	Trans.	Stapleton, Henry Ernest, Prof., B.A. and B.Sc. (Oxon.), Presidenc College, Calcutta, India
1870		Starey, Arthur John, 39, Woodland-gardens, Highgate, N.
1870	Trans.	‖Stark, James Fleming, Rosedale, Bromborough, Cheshire
1906		Starling, William Robert Rigg, 23, Magdalen-road, Norwich
1908		Stead, Arthur, B.Sc. (Vict.), Government Laboratories, Bloemfontein, Orange River Colony, S. Africa
1902		Stead, Francis Bernard, 80, St. Mary's-mansions, Paddington, W.
1896		Stead, John Christopher, 55, Chancery-lane, W.C.
1882	Trans.	Stead, John Edward, F.R.S., F.I.C., 11, Queen's-terrace, Middlesbrough
1910		Stedman, Ernest, B.Sc. (Vict.), 6, Breakwater-road, Bude, Cornwall
1897		Steel, Frederick William, c/o General Chemical Co., Ltd., Clyde, Sydney, N.S.W.
1885		‖Steel, Robert Elliot, Cameron House, Sherborne, Dorset
1900	Trans.	Steele, Bertram Dillon, D.Sc. (Melbourne), The University, Melbourne, Australia
1905		Steger, James, B.Sc. (Lond.), 111, Chesterfield-road, Bristol

Date of Election.		
1898		Steinhart, Oscar Julian, Ph.D. (Erlangen), 2 and 3, West-street, Finsbury Circus, E.C.
1901		Stell, Samuel Fenton, 25, Henry-street, Keighley
1892	Trans.	‖Stenhouse, James, View-park-gardens, Bonnyrigg, Midlothian
1884		Stenhouse, Thomas, F.I.C., 166, Drake-street, Rochdale
1895	Trans.	Stephens, Frank Robert, c/o Messrs. Idris, Pratt-street, Camden Town, N.W.
1880		‖Stephens, Henry Charles, Avenue House, Finchley, N.
1897		Stephens, Michael Edmund, 57, Aldersgate-street, E.C.
1910		Stephenson, Guy, Alexandra-terrace, Crook, Co. Durham
1895		Stephenson, Herbert Frederick, A.R.C.S., F.I.C., 7, Winifred-road, Merton Park, S.W.
1901		Stephenson, Robert, jun., M.A. (Cantab.), Burwell, Cambridge
1891	Trans.	Stephenson, Thomas, 137, George-street, Edinburgh
1888	Trans.	Stern, Arthur Landauer, D.Sc. (Lond.), F.I.C., 148, High-street, Burton-on-Trent
1896		Steuart, Douglas Stuart Spens, B.Sc. (Vict.), The Royal Societies' Club, St. James's-street, S.W.
1903	Trans.	Steven, Alec Bowring, B.Sc. (Lond.), Technical College, Glasgow
1905		Stevens, Edmund Henry, B.A. (Lond.), Haw House, Rothbury, Northumberland
1905		Stevens, Harold Blythen, Oxford Works, Tower Bridge-road, S.E.
1897	Trans.	Stevens, Henry Potter, M.A. (Oxon.), Ph.D. (Heidelberg), F.I.C., 15, Borough, London Bridge, S.E.
1903		Stevens, Montague White, A.R.C.S., A.I.C., H.M. Patent Office, 25, Southampton-buildings, W.C.
1899		Stevenson, Arnold, B.A. (Cantab.), 4, Porchester-gardens, W.
1903	Trans.	Stevenson, Henry Edward, Entwistle, Empress-avenue, Woodford, N.E.
1904		Stevenson, Henry Ernest, Avondale, Ditton Hill, Surrey
1909		Stevenson, James Thomas, 67, Surrey-street, Sheffield
1879		Stevenson, William, 95A, Southwark-street, S.E.
1908		Stewart, Alexander Mackintosh, Penang, Straits Settlements
1903	Trans.	Stewart, Alfred Walter, D.Sc. (Glas.), Valere, Rosetta-park, Belfast
1902		Stewart, Hector, Wagin, Western Australia
1907		Stobie, Harold Ramsay, Rio Tinto, Spain
1866		Stock, William Frederick Keating, F.I.C., 5, Dixon-terrace, Darlington
1887		Stocks, Herbert Birtwhistle, F.I.C., 12, Victoria-road, West Kirby, Cheshire
1894	Trans	Stoddart, Frederick Wallis, F.I.C., Grafton Lodge, Sneyd-park, Bristol
1879	Proc.	‖Stokes, Alfred Walter, F.I.C., Town Hall, Paddington Green, W.

Date of Election.		
1873		||Stone, Edward Daniel, Ackersley, Cheadle Hulme, near Stoc port, Cheshire
1895		Stone, George, Esk Brewery, Launceston, Tasmania
1875		||Stone, John Frederic Matthias Harris, M.A. (Cantab.), Barrist at-Law of the Western Circuit, 3, Dr. Johnson's-buildin Temple, E.C. ; and Oxford and Cambridge Club, 17, Pall Ma S.W.
1879		||Stone, William, M.A. (Cantab.), Oxford and Cambridge, Garric Bath, Union, Royal Societies, Automobile, and Reform Club and 63, Curzon-street, Mayfair, W.
1909		Stones, George Bertram, M.Sc. (Manc.), Bank-villas, Tyldesl Manchester
1906		Storey, Francis Wylie, B.Sc. (Lond.), Grey College Scho Bloemfontein, Orange River Colony, S. Africa
1900		Storr, Bertram Vincent, M.Sc. (Vict.), 147, Coventry-road, Ilfo Essex
1909		Strachan, James Thallon, 10, Nelson-street, Sunderland
1887		||Strangman, James Pim, Clydesdale-mansions, 9, Clydesdale-ro Notting Hill, W.
1904	Trans.	Streatfeild, Frederick Henry, 9, Crescent-road, South Tottenham,
1906		Streimer, Emanuel George, 4, Clova-road, Forest Gate, E.
1909		Strohmenger, Arthur Percy, Caxton House, Westminster, S.W
1900		Strong, Archie Hugh, 63, Herne-hill-road, Camberwell, S.E.
1904	Trans.	||Struthers, Robert de Jersey Fleming-, M.A. and B.Sc. (Oxon Exeter College, Oxford
1885	Trans.	||Stuart, Charles Maddock, M.A. (Cantab.), F.I.C., St. Dunsta College, Catford, S.E.
1910		Stuart, Murray, B.Sc. (Birm.), 27, Chowringhee, Calcut India
1897	Trans.	Stubbs, George, Beresford House, Beresford-road, East Finchl N.
1907		Sturrock, George Colleymore, Capt. R.A., Indian Cord Factory, Aruvankad, Nilgiris, India
1890	Trans.	||Sudborough, John Joseph, Prof., D.Sc. (Lond.), Ph.D. (Heid berg), F.I.C., University College of Wales, Aberystwyth
1878	Trans.	||Suguira, Shigetake, c/o Tokyo Chemical Society, Science Colle Imperial University, Tokyo, Japan
1897		Sumner, Leonard, B.Sc. (Vict.), Butt Hill, Prestwich, near Ma chester
1904		Sutcliffe, Thomas, The Grammar School, Elland, Yorks.
1887		||Sutherland, David Alexander, F.I.C., 26, Victoria-street, We minster, S.W.
1860		Sutton, Francis, F.I.C., Laboratory, Bank Plain, Norwich

Date of Election.		
1886		‖Sutton, Francis Napier, F.I.C., 6, Grosvenor-gardens, Cricklewood, N.W.
1902		Swain, James, 17, Winsham-grove, Clapham Common, S.W.
1875		Swan, Sir Joseph Wilson, Hon. M.A. and Hon. D.Sc., (Dun.), F.R.S., F.I.C., Overhill, Warlingham, Whyteleaf, S.O., Surrey
894		‖Swinburne, James, F.R.S., M.Inst.C.E., 82, Victoria-street, S.W.
891		Sykes, Matthew Carrington, M.D. (Dun.), F.R.C.S. (Edin.), M.R.C.S. (Eng.), L.R.C.P. and D.P.H. (Lond.), County Maynar Tower, Hemel Hempstead
880		Symons, Brenton, M.Inst.C.E., Burwood, Warminster-road, South Norwood, S.E.
874	Trans.	‖Symons, William Henry, M.D. (Brussels), D.P.H. (Oxon.), M.R.C.S. (Eng.), F.I.C., Health Office, Guildhall, Bath
899	Trans.	Szarvasy, Charles Emerique, Prof., Ph.D. (Buda Pesth), Müegyetem I Ker., Budapest, Hungary
881	Trans.	‖Takamatsu, Toyokichi, Prof., Engineering College, Imperial University, Tokyo, Japan
887	Trans.	‖Takamine, Jokichi, 550, West 173rd-street, New York City, U.S.A.
906		Talbot, George Stanley, c/o Pacific Phosphates Co., 60A, Pitt-street, Sydney, N.S.W.
901		Tankard, Arnold Rowsby, F.I.C., 40, Lowgate, and 12, Ferens-avenue, Cottingham-road, Hull
909		Taplin, Edward Walter, c/o Messrs E. Lacon & Co., Ltd., The Brewery, Great Yarmouth
909		Tapp, Charles, Cradock, Cape Colony, S. Africa
901		Tatam, George William Gerald, 38, Clark-street, Chattanooga, Tenn., U.S.A.
909		Tate, Arthur Edwin, M.Sc. (Dun.), Gladstone House, Salter-row, Pontefract
908		Tate, Francis George Henry, Kilmersdon, Homecroft-road, Sydenham, S.E.
890		Tate, Francis Henry, 9, Hackins Hey, Liverpool
881	Trans.	Tate, George, Ph.D. (Würzburg), F.I.C., Windsor Buildings, George-street, Liverpool
884		‖Tate, Walter, Woodlands, Twerton-on-Avon, Bath
890		Tate, William, Prof., c/o Messrs. Thos. Cook & Son, Ludgate Circus, E.C.
867		Tatlock, Robert Rattray, F.I.C., Kilarden, Rosneath, Dumbartonshire
905		Tayleur, John William, B.Sc. (Lond.), University College, Reading
882		Taylor, Gotfred Midgley, Caxton House, Westminster, S.W.

Date of Election.		
1894		Taylor, Herbert John, 52, Alexandra-crescent, Dewsbury
1880		‖Taylor, James, B.Sc. (Manc.), A.R.S.M., Adderton, Dundas, N.S.W.
1891		Taylor, John, 15, Lucius-street, Torquay
1888		Taylor, John George, 3, Outram-street, Stockton-on-Tees
1874	Trans.	‖Taylor, Robert Llewellyn, F.I.C., 4, St. Werburgh's-road, Chorlton-cum-Hardy, Manchester
1901		Taylor, William Henry, B.Sc. (Lond.), F.I.C., 36, Glenhouse-road, Eltham Park, Kent
1878		‖Tcherniac, Joseph, Ph.D. (Zürich), c/o South Metropolitan Gas Co., 709, Old Kent-road, S.E.
1907		Tebb, William Scott, M.A., M.D. and D.P.H. (Cantab.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), L.S.A., F.I.C., Hopedale, Worple-road, Epsom
1879	Trans.	‖Teed, Frank Litherland, D.Sc. (Lond.), F.I.C., 9, Mincing-lane, E.C.
1906		Telling, Harry George, Cooksbridge Brewery, Cooksbridge, Sussex
1906		Tempany, Harold Augustine, B.Sc. (Lond.), F.I.C., St. Johns, Antigua, British West Indies
1894		‖Terry, Edwin, 374, Brixton-road, S.W.
1893		Thackrah, James Robert, M.A. (Oxon.), Ph.D. (Leipzig), Technical Schools, Tavistock-road, Plymouth
1895		Theodosius, Alfred Fletcher, M.A. (Oxon.), University College, Oxford
1904		Thibault, Paul John, Somerset, Union-street, Tighe's-hill, Newcastle, N.S.W.
1899		Thiersch, Harry Alexander, c/o British Resin Works, Ltd., Belvedere, S.O., Kent
1910	Trans.	Thole, Ferdinand Bernard, B.Sc. (Lond.), 23, Cowper-avenue, East Ham, E.
1901		Thomas, Albert Edward, B.Sc. (Lond.), F.I.C., Boys' Middle School, Castle-street, Tiverton, Devon
1908		Thomas, Frank Moreton, 261, Rotton-park-road, Edgbaston, Birmingham
1907	Trans.	‖Thomas, Frederick, M.Sc. (Manc.), 29, Fairhaven-road, St. Anne's-on-the-Sea, Lancs.; and The University, Leeds
1905		Thomas, George Devenish, B.Sc. (Lond.), 18, Randolph-gardens, Dover
1875	Trans.	‖Thomas, Joseph William, F.I.C., Overdale, 6, Kingswood-road, Shortlands, Kent
1909		Thomas, Oswald John Dalgatty, c/o The International Cement Mill, Hull, Quebec, Canada
1907	Trans.	Thomas, Richard Noel Garrod, B.A. (Oxon.), 25, Clytha-park, Newport, Mon.

Date of Election.			
1877			‖Thompson, Beeby, 67, Victoria-road, Northampton
1904			Thompson, Charles Herbert, Harrington House, Amblecote, Stourbridge
1886	Trans.		‖Thompson, Claude Metford, Prof., M.A. (Cantab.), D.Sc. (Lond.), University College, and 38, Park-place, Cardiff
1894			Thompson, Edward Cumming, Froyle House, Westcombe Park-road, S.E.
1893			‖Thompson, Frank Ernest, A.R.C.S., F.I.C., 23, Lichfield-street, Walsall
1893			Thompson, George Rudd, F.I.C., The Laboratory, 69, Dock-street, Newport, Mon.
1897			Thompson, Harry, Chemical Laboratory, 5, Bishop-lane, Hull
1904			Thompson, Hubert, B.Sc. (Vict.), Agricultural College, Holmes Chapel, Cheshire
1886			Thompson, William Phillips, Rock Edge, Upper-park, Birkenhead
1909			Thoms, Hermann, Prof., Ph.D., Hohenzollernstrasse, 3, Steglitz, Berlin, Germany
1903			Thomson, George Malcolm, Newington, Dunedin, New Zealand
1872	Trans.	C. 1880-3, 1904-06 S. 1883-98 V.P. 1898-1901	‖Thomson, John Millar, Prof., Hon. LL.D. (Glas.), F.R.S., F.I.C., King's College, Strand, W.C.; and 9, Campden Hill-gardens, W.
1899			Thomson, Robert Tatlock, F.I.C., 156, Bath-street, Glasgow
1872			Thomson, William, F.I.C., Royal Institution Laboratory, Manchester
895			Thomson, William Thomas, Broom Hall, Waltham Abbey
882	Trans.		Thorne, Leonard Temple, Ph.D. (Würzburg), F.I.C., 2, Denbigh-gardens, Richmond, Surrey
906			Thornton, Percy Charles, Council School, Arnot-street, Walton, Liverpool
906			Thorp, Arthur William, 210, Sherborne-road, Yeovil
891			Thorp, Walter, B.Sc. (Lond.), F.I.C., Sorrentoville, Dalkey, Co. Dublin
871	Trans.	C. 1879-83 V.P. 1884-7 T. 1889-99 P. 1899-1901	†‖Thorpe, Sir Edward, Prof., C.B., D.Sc. (Vict.), Sc.D. (Dub.), Ph.D. (Heidelberg), LL.D. (Glas.), F.R.S., Imperial College of Science and Technology, South Kensington, S.W.
893	Trans.		Thorpe, Jocelyn Field, D.Sc. (Manc.), Ph.D. (Heidelberg), F.R.S., The University, and 5, Endcliffe Hall-avenue, Sheffield
899	Trans.		Threlfall, Richard, Prof., M.A. (Cantab.), Assoc. M. Inst. C.E., F.R.S., Oakhurst, Church-road, Edgbaston, Birmingham
897	Trans.		‖Tickle, Thomas, B.Sc. (Lond.), F.I.C., 83, Queen-street, Exeter
902			Tidy, Henry Letheby, M.A., M.B., and B.Ch. (Oxon.), M.R.C.S. (Eng.), M.R.C.P. (Lond.), 103, Clarence-gate-gardens, Regent's Park, N.W.

† Longstaff Medallist, 1881.

Date of Election.			
1903			Tilburn, Charles, c/o The Australian Explosives and Chemical Co., Ltd., Deer Park, Victoria, Australia
1865	Trans.	C. 1878-81 V.P. 85-8 91-94, 96-9 T. 1899-03 P. 1903-05	‖Tilden, Sir William Augustus, Emeritus Prof., D.Sc. (Lond.), Hon. Sc.D. (Dub.), Hon. D.Sc. (Vict.), Hon. LL.D. (Birm.), F.R.S., F.I.C., The Oaks, Northwood, S.O., Middlesex
1900			Tilley, James Walter, 95a, Southwark-street, S.E.
1909			Tilley, Vernon James, A.I.C., Linthorpe, Becmead-avenue, Streatham, S.W.
1907			Timpany, Harold Munkman, M.Sc. (Vict.), St. Winifrede's-gardens, Shrewsbury
1904	Trans.		Tingle, Alfred, B.Sc. (Lond.), Ph.D. (Penn.), c/o Prof. J. Bishop Tingle, Ph.D., McMaster University, Toronto, Canada
1889	Trans.		‖Tingle, John Bishop, Prof., Ph.D. (Munich), McMaster University, Toronto, Canada
1909			Tingle, Joseph Grantley, c/o The Pacific Phosphates Co., Ltd., A.M.P. Buildings, Collins-street, Melbourne, Australia
1907	Trans.		Tinkler, Charles Kenneth, D.Sc. (Birm.), B.Sc. (Wales), The University, Edgbaston, Birmingham
1898			Tisdale, Charles William Walker, The Dairy, Northallerton, Yorks.
1905	Trans.		Titherley, Arthur Walsh, D.Sc. (Vict. and L'pool.), Ph.D. (Heidelberg), Southcot, Manor-hill, Upton, near Birkenhead
1909	Trans.		Tizard, Henry Thomas, B.A. (Oxon.), 23, Geneva-road, Kingston-on-Thames
1907			Toch, Maximilian, 52, Ninth-street, Long Island City, N.Y., U.S.A.
189			Tocher, James Fowler, B.Sc. (Aberd.), F.I.C., 5, Chapel-street, Peterhead
1884	Trans.		‖Tompson, Frederick William, The Bower, Limpsfield, S.O., Surrey
1877			‖Toms, Frederick Woodland, F.I.C., Official Analyst, Jersey
1904			Tong, Walter, Holmdene, Pole-lane, Failsworth, Manchester
1904			Tonkin, Arnold Bertram, Government Laboratory, Durban, Natal, S. Africa
1906			Tonkin, Ronald William, 37, Oak-hill-road, Putney, S.W.
1907			Tonner, William Griffiths, B.Sc. (Wales), Dan-y-Bryn, Penywern-road, Neath, Glam.
1893			‖Towers, John William, Victoria-road, Widnes
1902			Toyne, Francis Digby, M.A. (Cantab.), 51, Deeplish-road, Rochdale
1901			Tozer, Herbert Ackerman, B.A. (Lond.), 19, Divinity-road Oxford

Date of Election.		
1887		‖Traphagen, Frank Weiss, Prof., Ph.D. (Columbia), Colorado School of Mines, Golden, Colorado, U.S.A.
1900		Traquair, John, Glenfield Starch Works, Paisley, N.B.
1892	Trans.	Travers, Morris William, Prof., D.Sc. (Lond.), F.R.S., Indian Institute of Science, Bangalore, India; and c/o Messrs. Jeremiah Lyon and Co., 4, Lombard-court, E.C.
1906		Treble, Richard Lumley, B.Sc. (Dun.), Culham College, Culham, Oxon.
1908		Trechmann, Adolph Octavius, The Old Palace, Rochester, Kent
1895		Trehärne, Frederick Gwilym, Wrangbrook, Llanishen, near Cardiff
1888		‖Trewby, Herbert, Albion Mills, Tenter-street-east, E.
1881		‖Trigger, Oliver, F.I.C., Chemical Dept., Royal Arsenal, Woolwich, S.E.
1902		Trimen, Stephen Herbert, Survey Dept., Finance Ministry, Giza, Egypt
1897		Tripp, Edward Howard, Ph.D. (Marburg), The Modern School, Bedford
1905		Troye, Gustave Arthur, P.O. Box 2706, Johannesburg, S. Africa
1909		Truelove, Charles William, B.Sc. (Lond.), 41, Hampton-road, Forest Gate, E.
1905	Trans.	Tuck, William Bradshaw, D.Sc. (Lond.), University College, Gower-street, W.C.
1898	Trans.	Tucker, Samuel Auchmuty, Ph.B. (Columbia), Columbia University, New York City, U.S.A.
1889		Tucker, Willis Gaylord, M.D. (Albany), Ph.D. (Union Univ.), Medical College, Albany, New York, U.S.A.
1896		Tuckett, James Edwin Shum, M.A. (Cantab.), Marlborough College, Marlborough
1892		Tuer, Arthur Holt, Douglas House, Worthington, Wigan
1902		Tunnicliffe, William Wright, B.Sc. (Lond.), The Herbert Strutt School, Belper
1897		Turnbull, Andrew, Ph.D. (Heidelberg), 18, Hackin's Hey, Liverpool
1906	Trans.	Turnbull, Robert Hutchison, F.I.C., c/o Messrs. MacAndrews and Forbes Co., 3rd-street and Jefferson-avenue, Camden, N.J., U.S.A.
1903		Turner, Arnold, 84, Molesworth-street, Rochdale
1886		Turner, Arthur, The Limes, Aylesbury
1897		Turner, Basil William, 83, Pitt-street, Sydney, N.S.W.
1896		Turner, Benjamin Bernard, B.Sc. (Lond.), Ph.D. (Göttingen), 261, W. Hoffmann-street, Baltimore, Md., U.S.A.
1888	Trans.	Turner, Charles, 225A, Oxford-street, Manchester
1906		Turner, George Augustus, 12, The Foregate, Worcester
1897		Turner, John Scriven, 20, Bury-street, Bloomsbury, W.C.

Date of Election.			
1883	Trans.		‖Turner, Thomas, Prof., M.Sc. (Vict.), A.R.S.M., F.I.C., The University, Edgbaston, Birmingham
1903	Trans.		Turner, William Ernest Stephen, M.Sc. (Birm.), B.Sc. (Lond.), The University, Sheffield
1889	Trans.		Turpin, George Sherbrooke, M.A. (Cantab.), D.Sc. (Lond.), High School, Nottingham
1871			‖Tustin, John Robert, Albion House, The Marina, Deal
1905	Trans.		Tutin, Frank, 9, Haverfield-gardens, Kew, Surrey
1888	Trans.	C. 1909-	Tutton, Alfred Edwin Howard, M.A. and D.Sc. (Oxon.), F.R.S., 41, Ladbroke-square, W.
1892			Tweedie, Thomas Shortridge, Trensano, Annan, N.B.
1907			Twiney, William George, B.Sc. (Lond.), Stoneleigh, Blenheim-road, Caversham, Reading
1904	Trans.		Twiss, Douglas Frank, M.Sc. (Birm.), B.Sc. (Lond.), F.I.C., The Municipal Technical School, Suffolk-street, Birmingham
1899	Trans.		Tyler, Ernest Albert, M.A. (Cantab.),33, The Promenade, Mount Pleasant, Swansea
1876			Typke, Paul George William, F.I.C., Lawn House, New Malden, Surrey
1876			Tyrer, Thomas, F.I.C., Stirling Chemical Works, Abbey-lane, Stratford, E.
1903			Tyrrell, Dennis, 182, King-street, Norwich
1908			Tyson, Thomas Marshall, 109, Carpenters-road, Stratford, E.
1865			Umney, Charles, F.I.C., 50, Southwark-street, S.E.
1893	Trans.		Umney, John Charles, 50, Southwark-street, S.E.
1889			‖Underhill, Thomas John, Stanley, Quernmore-road, Bromley, Kent
1904			Underhill, William Wood, 10, Hartham-road, Holloway, N.
1897			‖Unwalla, Rustomji Navroji, MedicalDept., Bhaunagar, Kathiawâr, India
1909	Trans.		Usher, Francis Lawry, B.Sc.(Lond.), Brooklyn, Hornsey-lane, N.
1882			‖Vacher, Francis, F.R.C.S., and M.R.C.P. (Edin.), 7, Shrewsbury-road, Birkenhead
1890			Valentin, Basil William, Messrs. Buckley Bros., Brewery, Llanelly, S. Wales
1909			Van Essen, Everard Cecil, 28, Hereford-road, Snaresbrook, N.E.
1903			Van Laer, Norbert, c/o Messrs. Truman, Hanbury, Buxton and Co., Ltd., Burton-on-Trent
1901			Varley, Harold Fay Fleetwood, 3, Sunset-view, Ilkley

Date of Election			
1909			Varley, Reginald Wells, c/o Leys Malleable Castings Co., Ltd, Derby
1883			Vasey, Samuel Archibald, F.I.C., Beechcroft, Burnt Ash-lane, Bromley, Kent
1894			Vaux, Cuthbert, 11, Thornhill-park, Sunderland
1879	Trans.		Veley, Victor Herbert, M.A. and D.Sc. (Oxon.), F.R.S., 8, Marlborough-place, N.W.
1891			Velling, Frederick William de, B.A., Higher Grade Board School, The Boulevard, Hull
1881			Venable, Francis Preston, Ph.D. (Göttingen), Chapel Hill, North Carolina, U.S.A.
1887			‖Vergara, Vargas José Maria, Apartado No. 237, Bogotá, Colombia
1901			Verteuil, Joseph de, Clarence-street, Port of Spain, Trinidad, British West Indies
1897			Viccajee, Framjee Khurshedjee, c/o Messrs. King, King & Co., P.O. Box 110, Fort, Bombay, India
1908			Vidyant, Hari Prasad, M.A. (Allahabad), C.E., Executive Engineer, Muckbulganj, Lucknow, India
1884			‖Voelcker, Edward William, A.R.S.M., F.I.C., 22, Tudor-street, Blackfriars, E.C.
1884		{C.1891-5, 1902-04}	‖Voelcker, John Augustus, Hon. M.A. (Cantab.), Ph.D. (Giessen), B.A. and B.Sc. (Lond.), F.I.C., 20, Upper Phillimore-gardens, Kensington, W.
1889			‖Voss, Walter Arthur, Eastwood-road, Rayleigh, Essex
1885			Vulté, Hermann T., Ph.D., Columbia University, New York City, U.S.A.
1901			‖Wade, Frank, A.R.C.S., F.I.C., 26, St. Ronan's-avenue, Southsea; and Laboratory, H.M. Dockyard, Portsmouth
1890	Trans.	C.1905-09	‖Wade, John, D.Sc. (Lond.), F.I.C., Hunstanton Lodge, Downe, Kent; and Guy's Hospital, London Bridge, S.E.
1903	Trans.		Wadmore, John Mello, M.A. (Oxon.), Aldenham School, near Elstree, Herts.
1894			‖Wagner, William George, 12, North Common-road, Ealing, W.
1893			Wait, Charles Edmund, Prof., University of Tennessee, Knoxville, U.S.A.
1888			‖Wait, Frank Goodell, Geological Survey Department, Ottawa, Canada
1899			Walden, Allan Frederick, M.A. (Oxon.), New College, Oxford
1897			Walford, Samuel Matthew, Wyncote, Hatherlow, Stockport
1909			Waliaschko, Nikolai A., Prof., Pharmaceutical Laboratory, Sumskaja 41, Charkow, Russia

Date of Election.			
1881			‖Walker, Archibald, M.A. (Oxon.), F.I.C., Newark Castle, Ayr, N.B.
1898	Trans.		‖Walker, Andrew Jamieson, Ph.D. (Heidelberg), B.A. (Dub.), 37, Charnwood-street, and Municipal Technical College, Derby
1899			Walker, Charles, Kuranda, Waverley-street, Waverley, N.S.W.
1894	Trans.		Walker, Charles Henry Hirst, M.A. (Oxon.), 1, Victoria-terrace, Corkickle, Whitehaven
1889			Walker, Daniel, School of Mines, Ballarat, Victoria, Australia
1906			Walker, Franklin Wilfred, 48, Blandford-road, Bedford Park, W.
1909			Walker, George Bilderbeck, Vale House, Trafalgar-road, Greenwich, S.E.
1908			Walker, Herbert, Whyttington, Station-road, Wealdstone, N.W.
1890	Trans.	C 1899-04 V.P. 1909-	‖Walker, James, Prof., D.Sc. (Edin.), Ph.D. (Leipzig), Hon. LL.D. (St. Andrews), F.R.S., The University, and 5, Wester Coates-road, Edinburgh
1890			Walker, James Samuel Hourston, M.B. and C.M., (Edin.), D.P.H. (Cantab.), Clinical Research Association, Watergate House, Adelphi, W.C.
1897	Trans.		Walker, James Wallace, Prof., M.A. (St. Andrew's), Ph.D. (Leipzig), McGill University, Montreal, Canada
1888			Walker, John Thom Ainslie, 64, Cannon-street, E.C.
1903			Walker-Pole, Miles, 71, De Korle-street, Braamfontein, Johannesburg, S. Africa
1905			Wall, Francis Henry, 1, Part-street, Southport
1884			‖Wallace, Robert, Prof., The University, Edinburgh
1878			‖Waller, Elwyn, A.M. (Harvard), Ph.D. (Columbia), 7, Franklin-place, Morristown, N.J., U.S.A.
1904			Walling, Léon Edward, 16, Beechhill-road, Eltham, Kent
1902			‖Wallis, Thomas Edward, B.Sc. (Lond.), F.I.C., 96, Stephens-road, Tunbridge Wells, Kent
1883			‖Walmsley, Robert Mullineux, D.Sc. (Lond.), Northampton Institute, St. John-street, Clerkenwell, E.C.; and 23, Hilldrop-road, Camden-road, N.
1905	Trans.		Walpole, George Stanley, B.Sc. (Melbourne), A.I.C., The Wellcome Physiological Research Laboratories, Brockwell Hall, Herne Hill, S.E.
1888			Walrond, Edward Dalrymple, M.A. (Cantab.), North Eastern County School, Barnard Castle, Durham
1903			Walsh, Thomas Crosbie, Ingenio "La Esperanza," San Pedro de Juguy, F.C.C.N., Argentine Republic, S. America
1899			Walton, Robert Hawks, Flinders, Martin's-avenue, Bondi, Sydney, N.S.W.
1909			Walton, Sidney Gilbert, Kensington, Northwood-road, Northwood, Lane Cove River, N.S.W.

Date of Election.		
1884		‖Walton, Thomas Utrick, B.Sc. (Glas.), F.I.C., Colonial Sugar Refining Co., Sydney, N.S.W.
1905		Want, William Phillip, 11, Pearfield-road, Forest Hill, S.E.
1864		Ward, George, F.I.C., Buckingham-terrace, Headingley, Leeds
1908		Ward, Herbert Horace, University College of Wales, Aberystwyth
1910		Ward, Percy George, B.Sc. (Lond.), A.R.C.S., The Lodge, Preston Park, Brighton
1891		Ward, Thomas Armistead, 15, Exchange-street, Blackburn
1907		Warner, Charles Horne, B.Sc. (Lond.), A.I.C., The Pharmaceutical Society, 17, Bloomsbury-square, W.C.
1871		Warner, George Joseph, Halton Villa, Widnes
1906		Warren, Richard Alfred, Belle Vue, Hallow-road, Worcester
1888		Warrick, Frederic Walmsley, 6, Nile-street, City-road, N.
1895		Warrington, Thomas Cotterill, M.A. (Oxon.), 29, Stockwell-street, Leek, Staffs.
1909		Warwick, Guy Ransom, B.A. (Cantab.), 90, Lower Thames-street, E.C.
1906		Wasteneys, Hardolph, The Rockefeller Institute for Medical Research, 66th-street and Avenue A, New York City, U.S.A.
1882		Waterfall, Charles James, F.I.C., 4, Queen-square, Bristol
1901		‖Waterhouse, James, Major-General, I.S.C., Hurstmead, High-street, Eltham, Kent
1907		Watkins, Charles Rowlatt, B.A. (Cantab.), Imperial Customs Service, Custom House, Bombay, India.
1908		Watkins, Edwin John, 27, York-grove, Queen's-road, Peckham, S.E.
1885		‖Watson, Charles, Fairfield, Washwood Heath-road, Birmingham
1904	Trans.	Watson, Edwin Roy, M.A. (Cantab.), B.Sc. (Lond.), Dacca College, Dacca, Eastern Bengal, India
1887		‖Watson, Frederick Percy, 6 and 7, Bailgate, Lincoln
1899		Watson, Fred. Sheasby, B.Sc. (Vict.), Sandgate, Villiers-road, Woodthorpe, Nottingham
1906		Watson, Frederick William, B.Sc. (Lond.), F.I.C., Consolidated Gold Fields of South Africa, Ltd., P.O. Box 108, Germiston, Transvaal, S. Africa
1907		Watson, George Arthur, A.R.C.S.I., Clongowes Wood College, Sallins, S.O., Co. Kildare, Ireland
1908	Trans.	Watson, Herbert Edmeston, B.Sc. (Lond.), A.I.C., 26, Norland-square, Holland Park, W.
1904		Watson, Herbert Wood, B.Sc. (Vict.), Rose Villa, Roper-avenue, Gledhow, Leeds
1908		Watson, John, B.Sc. (Dun.), Dauntsey Agricultural School, West Lavington, Littleton Panell, Wilts.
1906		Watson, John Adam, 8, Powis-gardens, Notting Hill, W.

Date of Election.		
1883		‖Watson, Thomas Donald, 16, St. Mary's-road, Bayswater, W.
1876	Trans.	‖Watson, William Henry, J.P., Braystones House, Beckermet, Cumberland
1877		Watt, Alexander, F.I.C., c/o Messrs. Macfie and Sons, 34, Moorfields, Liverpool
1904		Watt, Francis Langston, A.R.C.S., F.I.C., Russenden, Stanley-street, Epping, near Sydney, N.S.W.
1906		Watt, George Gordon, 42, Valley-road, Streatham Hill, S.W.
1906	Trans.	Watt, Henry Edgar, D.Sc. (Dun.), F.I.C., Blandfield Chemical Works, Wheatfield-road, Edinburgh
1908		Watt, John, Rev., M.A. (Aberd.), 2, Cornwallis-Square, Calcutta, India
1908		Watt, Robert Dickie, Prof., M.A. and B.Sc. (Glas.), The University, Sydney, N.S.W.
1883	Trans.	Watts, Francis, C.M.G., D.Sc. (Birm.), F.I.C., Imperial Commissioner of Agriculture for the West Indies, Barbados, West Indies
1906		Watts, James Neill, P.O., Eikenhof, Johannesburg, S. Africa
1872	Trans.	‖Watts, John, M.A. (Oxon.), D.Sc. (Lond.), F.I.C., Merton College, Oxford
1878	Trans.	Watts, John Isaac, Beechfield, Hartford, Cheshire
1888		Way, Edward John, F.I.C., M.Inst.C.E., M.I.M.E., c/o Anglo, French Exploration Co., P.O. Box 2927, Johannesburg, S. Africa
1901		Wayland, William Abraham, 12, Albert-road, St. John's, S.E.
1883	Trans.	Webster, Charles Stuart Stanford, F.I.C., Malvern House, Redland, Bristol
1909		Webster, John, F.I.C., Laboratory of Pathological Chemistry, St. Mary's Hospital, Paddington, W.
1906	Trans.	Wechsler, Elkan, Ph.D. (Würzburg), 59, Petherton road, Canonbury, N.
1907		Wechsler, Marcus, D.Sc. (Grenoble), 136, Sinclair-road, Kensington, W.
1904		Weeks, Henry Bridges, F.I.C., The Retreat, Infield-park, Barrow-in-Furness
1908		Weighell, Arthur, Top Floor, Prince-building, Medows-street, Fort, Bombay, India
1905		Weiskopf, Eric Hartwig, Ph.D. (Toulouse), c/o Japanese Explosives Co., Ltd., Hiratsuka, Japan
1903		Weiss, Carl Friederich Richard, M.A. and Ph.D., (Bâle), 8, Harp-lane, E.C.
1898		Weissmüller, Edward Charles, Hill Crest, The Heath, Runcorn
1909	Trans.	Weizmann, Charles, D.Sc. (Manc.), Ph.D. (Freiburg), 57, Birchfields-road, Rusholme, Manchester

Date of Election.		
1901		Welch, George Edward, B.Sc. (Lond.), Grammar School, Wakefield
1893		Welchman, Frank Ernest, 16, Carlton-road, Putney Hill, S.W.
1891		Wellington, Stephen Newcombe, Assoc. M.I.E.E., c/o Coke Ovens and By-Products Co., Ltd., 181, St. Stephen's House, Westminster, S.W.
1884	Trans.	Wells, James S. Chester, Ph.D. (Columbia), 320 H. 83rd Street, New York City, U.S.A.
1890		Wells, Sydney Russell, M.D. and B.Sc. (Lond.), M.R.C.S. (Eng.), M.R.C.P. (Lond.), 16, Lower Seymour-street, Portman-square, W.
1903		Welsford, Giles Haddon, Royal Gunpowder Factory, Waltham Abbey, Essex
1897		Welsh, John, M.R.C.S. (Eng.), L.R.C.P. (Lond.), 43, Tarvin-road, Chester
1888	Trans.	Werner, Emil Alphonse, F.I.C., 1, Fairfield-park, Highfield-road, Rathgar, Dublin
1886		‖Wertheimer, Julius, Prof., B.A. and B.Sc. (Lond.), F.I.C., Merchant Venturers' Technical College, Bristol
1897	Trans	West, Charles Alfred, A.R.C.S., F.I.C., 9, Tideswell-road, Putney, S.W.
1902		West, Joseph, Beechwood, The Avenue, Kidsgrove, Stoke-on-Trent
1909		West, Percy Charles Henry, 35, Bouverie-street, Chester
1898		Weston, Frank Edwin, 43, Larkhall-rise, Clapham, S.W.
1892		Whalley, Lawrence John de, 18, Brandram-road, Lee, S.E.
1893		Whalley, Sidney, B.Sc. (Lond.), 18, Nevilledale-terrace, Durham
1908		Wheatley, William, B.A. (Oxon.), 13, St. Silas'-road, Blackburn
1906		Wheaton, Harold Joseph, 21, Chesterton-road, Cambridge
1907		Wheeler, Edward, A.C.G.I., 113, Highbury-quadrant, N.
1902		Wheeler, Edward J., Ph.D., 79, Chapel-street, Albany, N.Y., U.S.A.
1905		Wheeler, Ernest, c/o Messrs. Crossley Bros., Openshaw, Manchester
1894		Wheeler, Henry Lord, Ph.D. (Yale), The Sheffield Laboratory, New Haven, Conn., U.S.A.
1909	Trans.	Wheeler, Richard Vernon, D.Sc. (Manc.), Colliery House, Altofts, Normanton
1893		‖Wheeler, William Ernest, 33, Haverstock-road, Knowle, Bristol
1897		Wheelwright, Edwin Whitfield, B.A. (Oxon.), Ph.D. (Munich), F.I.C., Greenholme, 24, Stanmore-road, Edgbaston, Birmingham
1897		While, Arthur James, Glen Garth, Barrow-in-Furness
1879		Whitaker, Thorp, Bradford Dyers' Association, Ltd., Bradford

Date of Election.		
1891		White, Henry, 245, Western-road, Crookes, Sheffield
1893		White, Henry Clay, Prof., Ph.D. (Virginia), Hon. D.C.L. (Univ. South), Hon. LL.D. (Illinois), University, Athens, Georgia, U.S.A.
1899		White, Henry Fox, 52, Royal York-crescent, Clifton, Bristol
1905		White, John Ledger, D.Sc. (Dun.), 9, Sugden-road, Lavender Hill, S.W.; and Battersea Polytechnic, Battersea Park-road, S.W.
1889		‖White, John Tsawoo, M.A. (Calcutta), Pyinmana, Upper Burma, India
1905		White, John William, B.Sc. (Lond.), c/o The E.C. Powder Co., Green Street Green, Dartford
1897		White, Paul Thomas, Hortonfield House, West Drayton, Middlesex
1902		White, William Carter, Glenholme, Longlands-park-road, Sidcup, S.O., Kent
1893		‖White, William Gilchrist, Vicarage View, 133, Tottington-road, Bury, Lancs.
1885		Whitehead, Henry Hammond, 18, Boston-road, Brentford
1896		Whitehead, James, 8, West-street, Rochdale
1901		Whitehouse, Philip Lewington, c/o Messrs. W. H. Keys, Ltd., Hall End Works, West Bromwich
1889		‖Whitehouse, William, Albany House, Bradmore, Wolverhampton
1904	Trans.	Whiteley, Charles Edward, 21, Brudenell-view, Leeds
1886	Proc.	‖Whiteley, Richard Lloyd, F.I.C., Municipal Science and Technical School, West Bromwich
1892		Whiteside, John Lowe, 376, St. Helen's-road, Bolton
1863		‖Whitfield, John, 113, Westborough, Scarborough
1899		Whittaker, Christopher Joseph, c/o United Indigo and Chemical Co., Ltd., 1, Cooper-street, Manchester
1889		Whittam, Matthew, M.A. (Cantab.), 75, Creffield-road, West Acton, W.
1901		Whittle, James, 30, Bridge-street, Morpeth
1907		Whymper, Robert, A.C.G.I., St. Clare, St. Mary's-road, Ditton Hill, Surrey
1906		Wiffen, Henry John, 17, Albany-road, Manor-park, E.
1889		Wigan, Basil Penwarne, Rhondda Valley Brewery Co., Treherbert, Pontypridd
1905		Wigginton, John Henry Becker, 2, Kitson-road, Barnes, S.W.
1907		Wight, Robert Burt, M.A. (Cantab.), 114, Grange-road, Middlesbrough
1906		Wightman, Charles, 36, Curzon-street, W.
1896	Proc.	Wigner, John Harrison, Ph.D. (Heidelberg), 54, Keptie-street, Arbroath, N.B.
1896		Wilcox, Alfred James, Rev., Shapwick, Blandford

Date of Election.		
1891		‖Wild, John, B.Sc. (Vict.), A.I.C., Bredbury House, Bredbury, Stockport
1909		Wild, Thomas Jabez, c/o Messrs. Scotts' Laboratories, Southall
1898		‖Wild, William Ernest, B.Sc. (Vict.), Alexander-villas, Talbot-road, Glossop
1898		Wilder, Frederick Louis, Villa Nova de Lima, Minas Geraes, Brazil
1897	Trans.	Wilderman, Meyer, Ph.D. (Freiburg), B.Sc. (Oxon.), Davy-Faraday Research Laboratory, Albemarle-street, W.
1902	Trans.	Wilkinson, Edward John, 24, Bertram-road, Manningham, Bradford
1904		Wilkinson, James Alfred, M.A. (Cantab.), Transvaal University College, P.O. Box 1176, Johannesburg, S. Africa
1903		Wilkinson, James Bates, M.D. and C.M. (Edin.), D.P.H. (Vict.), Town Hall, Oldham
1893		Wilkinson, John, Corporation Gas Works, Halifax
1905		Wilkinson, John Wells, M.A. (Wales), Longhope, Essendene-road, Belvedere, S.O., Kent
1891		Will, Wilhelm, Prof., Ph.D. (Berlin), Colonie Grunewald, Boothstrasse 32, bei Berlin, Germany
1904	Proc.	Willcox, William Henry, M.D., B.Sc., M.R.C.P. and L.S.A. (Lond.), D.P.H. (Eng.), F.I.C., St. Mary's Hospital, Paddington, W.
1906		Willett, Herbert William Mills, The Cedars, Chislehurst, Kent
1905		Williams, Alan Herbert, Brockweir, Urmston, Manchester
1903		Williams, David John, Bath and West of England College of Chemistry and Pharmacy, 6, Cleveland-place, East Bath
1908		Williams, David Thomas, 42, Finsbury-square, E.C.
1895		Williams, Evan, Bradford-road Gas Works, Manchester
1908		Williams, Frederick, B.A. (Oxon.), Bute Villa, Aberdare, S. Wales
1909		Williams, Herbert Ernest, 23, Kenilworth-road, Beckenham-road, Penge, S.E.
1892		Williams, John, Government Laboratory, British Guiana
1908		Williams, Joseph Henry, 43, Prince's-road, Wimbledon, S.W.
1907	Proc.	Williams, Percy, B.Sc. (Lond.), c/o Wilhelmina Co., Pontianak, Dutch West Borneo
1883	Proc.	Williams, Rowland, F.I.C., Hale Cote, Albert-park, Lancaster
1891		Williams, Seward Whiting, c/o Messrs. Seabury and Johnson, East Orange, N.J., U.S.A.
1872		‖Williams, Thomas, Chemical Laboratory and Assay Office, 8, Victoria-street, Liverpool
1885	Trans.	‖Williams, Walter Collingwood, B.Sc. (Lond.), F.I.C., Public Analysts Laboratory, 36, Dansie-street, Liverpool

Date of Election.		
1892		Williams, William, M.A., M.D., B.Ch., and D.P.H. (Oxon.), M.R.C.S. (Eng.), County Health Department, 9, The Parade, Cardiff; and Bryn Derw, 31, Victoria-road, Penarth
1899	Proc.	Williams, William Arthur, 19, Craylockhart-terrace, Edinburgh
1874	Trans.	‖Williams, William Carleton, B.Sc. (Vict.), F.I.C., Broomgrove, Goring-on-Thames, Reading
1898		Williamson, John Alexander, The Croft, Chase Court-gardens, Enfield, Middlesex
1874	Trans.	‖Williamson, Robert, F.I.C., Messrs. Williamson and Corder, Ltd., Walker, Newcastle-on-Tyne
1886	Trans.	Williamson, Sidney, Ph.D. (Munich), F.I.C., c/o The Cooper Research Laboratory, Berkhamsted, Herts.
1898		Williamson, William, 94, Hainault-road, Leytonstone, N.E.
1907		Willott, David, B.Sc. (Lond.) Niton, Banstead-road, Carshalton, Surrey
1896		Wills, Sir Edward Chaning, Bart., M.A. (Cantab.), Rockstone, near Dawlish, S. Devon
1909		Wills, Harry Sampson, 9, Salehurst-road, Crofton-park, S.E.
1872		Wills, Joseph Lainson, 133, Midwood-street, Flatbush, Brooklyn, N.Y., U.S.A.
1906		Willstaetter, Richard, Prof., Ph.D. (Munich), Bergstrasse 25, Zürich V, Switzerland
1892	Trans.	Wilsmore, Norman Thomas Mortimer, D.Sc. (Melbourne), 126, Walm-lane, Willesden Green, N.W.
1885		Wilson, Alfred Charles, F.R.S.E., Borough Hall, Stockton-on Tees
1879		‖Wilson, Charles Joseph, F.I.C., 14, Old Queen-street, Westminster, S.W.
1894		Wilson, Christopher, The Grammar School, Manchester
1883	Trans.	‖Wilson, David, M.A. and D.Sc. (Glas.), Carbeth, Killearn, Glasgow
1901		‖Wilson, Duncan Randolph, 109A, Whitehall-court, S.W.
1899	Proc.	Wilson, Frederick Robert Leyland, M.A. (Oxon.), Charterhouse, Godalming
1908		Wilson, Harry Percy, 3, Audley-road, Colchester
1875		‖Wilson, James, M.A. (Dub.), Barrister-at-Law, 2, Essex-court, Temple; and 121, Claremont-road, Forest Gate, Essex
1890		Wilson, James Mitchell, M.D. and C.M. (Glas.), D.P.H. (Cantab.), County Hall, Beverley
1901		Wilson, James Scott, M.D. and C.M. (Glas.), D.P.H. (Cantab.), Bradford-street, Walsall
1895	Proc.	Wilson, John, M.Sc. (Vict.), F.I.C., Battersea Polytechnic, S.W.
1902		Wilson, Lyndon Charles, 31, Castle-gate, Newark-on-Trent
1900	Proc.	Wilson, Leonard Philip, 8, Chester-street, Coventry

Date of Election.		
1909	Trans.	Wilson, Robert William, 120, Wanstead-park-avenue, Wanstead, N.E.
1871		‖Wilson, William John, c/o Dr. W. M. Watts, Shirley, Venner-road, Sydenham, S.E.
1907		Wilson, William John, A.C.G.I., 12, Vicarage-park, Plumstead, Kent
1884		Wilton, Thomas, The Gas Light and Coke Co., Beckton, North Woolwich, S.E.
1893		Winder, Edward Humphreys, Felton, Ludlow
1894		Wingate, Hamilton More, B.Sc. (Glas. and Melbourne), 71, Queenswood-road, Forest Hill, S.E.
1895		Wingfield, Thomas Rowland, 5, Bromwich-street, Bolton
1876		Winser, Percy James, F.I.C., Heath House, Knutsford
1908	Trans.	Winterson, William George, B.Sc. (Lond.), 89, Salisbury-road, Barnet
1906		Winther, Christian, Ph.D. (Copenhagen), Ostervold 5, Copenhagen, Denmark
1898	Trans.	Witham, Ernest, B.A. and B.Sc. (Lond.), The Grammar School, Rotherham
1908		Withey, William Henry, B.A. (Cantab.), Walpole House, Church-road, Teddington, Middlesex
1876	Trans.	‖Witt, Otto Nikolaus, Geh. Rath Prof., Dr., Ebereschenallee 10, Westend bei Berlin, Germany
1906		Wolfe, Ernest Edwin, Kinsale, Co. Cork, Ireland
1910		Wolfenden, Stuart Jardine Norris, The Grange, Sidcup, S.O., Kent.
1907		Wolff, Mark Arthur, 6, Hanover-terrace, Holland-park, W.
1902		Womersley, Charles Edward, 7, Tidswell-street, Heckmondwike, S.O., Yorks.
1889		Wood, Charles, Rossemount, Emm-lane, Heaton, Bradford
1860	Trans.	‖Wood, Charles Henry, F.I.C., Erica, Bournemouth-road, Parkstone, S.O., Dorset
1908		Wood, Francis Charles Benjamin, Deurne, near Antwerp, Belgium
1902		Wood, Frank Stanley, Chin Chu, Heathcote-street, Newland, Hull
1898	Trans.	Wood, Thomas Barlow, Prof., M.A. (Cantab.), School of Agriculture, Cambridge
1903		‖Wood, William Francis John, B.Sc. (Lond.), Osborne House, Barnsley
1900		Woodbridge, Walter Bourne, A.C.G.I., c/o A. E. Woodbridge, Esq., The Steyne, Bognor
1871	Trans.	Woodcock, Reginald C., F.I.C., The Sanitas Co., Ltd., Locksley-street, Limehouse, E.

Date of Election.		
1904		Woodcock, William Henry, Craigfernie, Felbrigge-road, Goodmayes, Essex.
1898		Woodhead, Samuel Allinson, B.Sc. (Dun.), F.I.C., Agricultural College, Uckfield, Sussex
1909		Woods, George James, 2, Wellmeadow-road, Lewisham, S.E.
1892		‖Woods, Hugh, B.A., M.D. and B.Ch. (Dub.), D.P.H., (R.C.P.S.I.), Red House, Bordyke, Tonbridge
1888		Woodward, James, B.A. and B.Sc. (Lond.), F.I.C., Drummond House, 31, Coventry-road, Ilford, Essex
1889		Woolf, Mortimer, Mayfield, Mortimer-road, N.W.
1903		Woolhouse, Sidney Herbert, M.A. and B.Sc. (Dub.), A.R.C.S.I., 5, Latymer-road, Lower Edmonton, N.
1889		Woosnam, Richard William, F.I.C., 1, The Chase, Warby Mount, Brentwood, Essex
1908	Trans.	Wootton, Hubert Arthur, M.A. (Cantab.), B.Sc. (Lond.), 20, Great College-street, Westminster, S.W.
1908	Trans.	Wootton, William Ord, B.Sc. (Lond.), A.R.C.S., Chemical Department, St. Bartholomew's Hospital and College, E.C.
1903		Worden, Edward Chancey, M.A. (N.Y.), Clark Thread Co. Newark, N.J., U.S.A.
1908	Trans.	Worley, Frederick Palliser, M.A. and M.Sc. (N.Z.), Mansfield House, Clifton-gardens, Maida Hill, W.
1884		‖Worrall, Jason Hall, F.I.C., Howsley, Chapeltown, near Sheffield
1858		‖Worsley, Philip John, Rodney Lodge, Clifton, Bristol
1906		Wortley, Edward Jocelyn, Rectory, Half-way-tree, Jamaica
1906	Trans.	Wren, Henry, M.A. (Oxon.), B.Sc. (Lond.), Ph.D. (Tübingen), 22, Stapleton-hall-road, Stroud Green, N.
1905		Wren, William James, A.R.C.S., Hilton College, near Maritzburg, Natal, S. Africa
1898		Wrench, Charles Arthur, 95A, Southwark-street, S.E.
1908		Wright, Allister MacLean, P.O. Box 617, Christchurch, New Zealand
1908		Wright, Charles Harold, B.A. (Cantab.), A.I.C., Government Laboratory, Port of Spain, Trinidad, British West Indies
1895		Wright, Harold Edward, c/o Sir B. Samuelson and Co., Ltd., Middlesbrough
1909		Wright, Joseph Pretty, 883, Burrard-street, Vancouver, B. Columbia
1878	Trans.	Wright, Lewis Thompson, 10, Linden-gardens, Bayswater, W.
1894		Wright, Robert, 5, Devonshire-colonnade, Buxton
1886	Trans.	‖Wright, William Thomas, 11, Rundle-road, Sheffield
1864		‖Wrightson, John, Prof., Charford, Manor House, Downton, Salisbury

Date of Election.			
1880			Wyborn, John Middleton, Shoulden, Farnaby-road, Bromley, Kent
1884			‖Wyley, William Fitzthomas, Wheatley-street, Coventry
1885	Trans.	C. 1892-6, S. 1898-99, 1903-05, V.-P 1905-08.	‖Wynne, William Palmer, Prof., D.Sc. (Lond.), F.R.S., F.I.C., A.R.C.S., The University, and 17, Taptonville-road, Sheffield
1908			Yates, Harry James, M.I.M.E., Redcroft, Four Oaks, Warwickshire
1908	Trans.		Yates, Joseph, M.Sc. (Manc.), B.Sc. (Lond.), F.I.C., Municipal Technical School, Blackburn
1886	Trans.		Yoshida, Hikorokurō, Prof., Imperial University of Kyoto, Kyoto, Japan
1885			Young, Alfred Collett, 17, Vicar's-hill, Lewisham, S.E.
1903			Young, Andrew, M.A. and B.Sc. (Edin.), Geological Department, South African College, and 5, Rosmead-avenue, Cape Town, S. Africa
1886			‖Young, Brougham, 2A, Sigdon-road, Dalston-rise, N.E.
1908	Trans.		Young, Charles Robert, B.Sc. (Lond.), 11, Low-pavement, Nottingham
1897			Young, Francis Samuel, M.A. (Oxon.), F.I.C., The College, Bishop's Stortford
1877			‖Young, Frank Watson, F.R.S.E., 32, Buckingham-terrace, Botanic-gardens, Glasgow
1890	Trans.		‖Young, George, Ph.D. (Erlangen), F.I.C., Bradda, Church-crescent, Church End, Finchley, N.
1895			Young, Henry Stow, F.I.C., c/o The Borneo Co., Ltd., Kuching, Sarawak
1894			Young, James, 12, Edge-hill, Plumstead, Kent
1874			Young, John, 164, Bath-street, Glasgow
1910			Young, John, A.I.C., Highfield, Stanley-road, Teddington
1898			Young, John Henry, B.Sc. (Vict.), c/o Cassel Gold Extracting Co., Ruehill-road, Maryhill, Glasgow
1877			‖Young, John Rymer, 21, Palmyra-square, Warrington
1887	Trans.		Young, John William, B.A. and B.Sc. (Lond.), 22, Maxwell-drive, Glasgow, S.
1909			Young, Roland Francis, c/o Abosso Gold Mining Co., Abosso, Gold Coast, W. Africa
1882	Trans.	C. 1894-8.	‖Young, Sydney, Prof., D.Sc (Lond.), B.Sc. (Manc.), Hon. Sc.D. (Dub.), F.R.S., F.I.C., Trinity College, Dublin

Date of Election.			
1873			‖Young, William Charles, F.I.C., 2, Queen Anne's-grove, Bedford Park, W.; and Chemical Laboratory, 19/20, Aldgate, E.C.
1907	Trans.		Zortman, Israel Hyman, B.Sc. (Vict.), Ph.D. (Leipzig), 13, Skinner-lane, Leeds

NUMBER OF HONORARY AND FOREIGN MEMBERS ...	31
,, ,, FELLOWS	3020

R. CLAY AND SONS LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

PROCEEDINGS

OF

THE CHEMICAL SOCIETY.

Vol. XXVII. Nos. 380—394.
JANUARY—DECEMBER, 1911.

LONDON:
GURNEY & JACKSON, 10, PATERNOSTER ROW.
1912.

RICHARD CLAY AND SONS, LIMITED
BRUNSWICK ST., STAMFORD ST., S.E., AND
BUNGAY SUFFOLK

LIST OF GRANTS MADE FROM THE RESEARCH FUND DURING THE YEAR 1911.

£10 to E. C. C. Baly: the relation between absorption spectra and chemical activity (continued).

£10 to O. L. Brady: constitution of aconitine.

£5 to A. T. Cameron: physical and chemical properties of crystallised protein.

£10 to A. Campion: properties of the different forms of carbon and carbon compounds existing in iron and, more especially, cast iron.

£10 to D. Cardwell: synthesis of *apo*harmin.

£5 to F. W. Caton: absorption spectra of 2:3-diphenylpyrazines.

£10 to F. D. Chattaway: polymorphism among hydrazides and anilides.

£10 to A. Clayton: a comparison of the function of the oxygen and sulphur atoms in lactones and thiolactones.

£5 to Miss G. Cliffe: action of Grignard's reagents on β-chloropropionic ester and on amyloxypropionic ester.

£8 to T. Q. Chou: preparation of *iso*quinoline derivatives.

£10 to H. M. Dawson: dynamics of intramolecular change.

£5 to C. Dorée: constitution of cholesterol.

£7 to A. C. Dunningham: equilibria of partially miscible liquids.

£10 to J. Ferns: reactions of some derivatives of sulphonic acids.

£3 to C. H. Hampshire: constitution of picrotoxin.

£10 to R. T. Hardman: electromotive forces in alcohol.

£10 to T. P. Hilditch: quantitative nature of molecular rotatory power in normal homologous series.

£10 to E. Hope: condensation of cotarnine with other nitro-compounds.

£15 to E. Hope: condensation products of cotarnine with certain ketones, imines, and hydrocarbons.

£10 to A. Hopwood: the synthesis of naphthyltyrosine and of the polypeptides of tyrosine. The action of ferments on the polypeptides of higher fatty acids.

£22 10. to T. E. Hull: annealing and heat treatment of steels.

£5 to T. C. James: iodocinnamic acids. The addition of halogens to compounds containing a double bond between carbon and nitrogen.

£5 to J. Kenner: synthesis of phenanthrene.

£12 to F. R. Lankshear : epicamphor.
£10 to T. M. Lowry : dynamic isomerism.
£10 to J. W. McBain : constitution of soap solutions.
£10 to J. W. McDavid : synthesis of harmin.
£5 to A. N. Meldrum : synthesis of substances related to cochenillic and carminic acids
£5 to J. E. Myers and J. B. Firth : action of sodium hyposulphite on copper sulphate.
£10 to W. Parry : action of Grignard's reagents on ethyl-α-hydroxy-α-ethylbutyrate.
£10 to R. S. Pollard : synthesis of substances allied to cotarnine.
£15 to J. N. Pring : reduction of refractory oxides by hydrogen at high temperatures.
£15 to W. M. Roberts : synthesis of pseudo-opianic acid. Derivatives obtained by the action of mixed organo-metallic compounds on esters of higher fatty dibasic acids.
£25 to R. Robinson : synthesis of *iso*quinoline alkaloids.
£5 to D. Segaller : the velocity-coefficients of some iodo-compounds with sodium phenoxide in alcoholic solution at various temperatures.
£5 to R. E. Slade : use of the hydrogen electrode in determining the dissociation constants of acids and bases.
£8 to Miss I. Smedley : constitution of the higher fatty acids.
£10 to S. Smith : tribromoxylenols.
£5 to F. B. Thole : relation between the residual affinity of liquids and their dissociating influence on associated solutes.
£8 to H. T. Tizard : ionisation constant of water at different temperatures.
£8 to W. E. S. Turner : solubilities of salts.
£12 to D. Tyrer ; several important problems in physical chemistry.

Total amount granted during 1911 = £393. 10. 0.

LIST OF FELLOWS ELECTED DURING 1911.

Name.	Proposed.	Elected.
Acree, Solomon Farley	January 19th, 1911	February 16th.
Adendorff, John Ernest Roux	March 16th, 1911	May 4th.
Allan, James, M.A., B.Sc.	December 15th, 1910	February 16th.
Anderson, Edward	November 17th, 1910	,, ,,
Ashe, Albert	December 1st, 1910	,, ,,
Atkins, Ernest Andrew	April 6th, 1911	June 15th.
Atkinson, Norman Ernest	May 18th, 1911	,, ,,
Auld, Samuel James Manson, D.Sc., Ph.D.	February 16th, 1911	May 4th.
Barbary, John Ewart Trounce	January 19th, 1911	February 16th.
Bate, Joseph	December 15th, 1910	,, ,,
Bennison, Ernest Carr	March 16th, 1911	May 4th.
Bescoby, Arthur Cecil, B.A.	October 19th, 1911	December 7th.
Blackburn, Joseph Mayson	December 15th, 1910	February 16th.
Blackhurst Arthur Owen	May 4th, 1911	June 15th.
Bowden, Richard Charles, B.Sc.	March 16th, 1911	May 4th.
Bowyer, Arthur Stewart, M.Sc.	February 16th, 1911	,, ,,
Bradshaw, George Arthur, M.Sc.	April 6th, 1911	June 15th.
Bull, Bertram Alfred	October 19th, 1911	December 7th.
Bull, Joseph Beauchamp	,, ,, ,,	,, ,,
Burbridge, Walter Norman	November 17th, 1910	February 16th.
Carmichael, John Fisher, B.Sc.	November 17th, 1910	February 16th.
Charlton, Edwin Johnson, M.Sc.	October 19th, 1911	December 7th.
Christopher, Harold, B.Sc.	January 19th, 1911	February 16th.
Clarke, Arthur Frederick	April 6th, 1911	June 15th.
Collington, John Eric	February 2nd, 1911	May 4th.
Cooke, Charles Ernest	April 6th, 1911	June 15th.
Cowling, Thomas	May 18th, 1911	,,
Crook, Clement Arthur	February 2nd, 1911	May 4th.
Cutner, Morris, B.Sc.	December 1st, 1910	February 16th.
Crymble, Cecil Reginald, B.Sc.	February 16th, 1911	May 4th.
Datta, Atulchandra, M.A.	March 16th, 1911	May 4th.
Datta, Ganesh, B.A.	May 4th, 1911	June 15th.
Demuth, Rudolph	,, 18th, 1911	,, ,,
Devlin, James Edward A.	December 1st, 1910	February 16th.
Dickinson, William Henry, M.B., Ch.B.	February 2nd, 1911	May 4th.
Douse, Oliver Statham, B.Sc.	,, 16th, 1911	,, ,,
Dryden, Harold Edgar	January 19th, 1911	February 16th.
Dutt, Barun Chandra, M.A.	October 19th, 1911	December 7th.
Eardley, James Furnival	January 19th, 1911	February 16th.
Eggington, Alfred Thomas, B.Sc.	March 2nd, 1911	May 4th.
Eldridge, Arthur Alfred, B.Sc.	,, ,, ,,	,, ,,
Elkington, Algernon John	,, 16th, 1911	,, ,,
Emerson, Robert Leonard, A.B., M.D.	January 19th, 1911	February 16th.

Name.	Proposed.	Elected.
Empson, Alfred Walker	March 16th, 1911	May 4th.
Enfield, Ralph Roscoe, B.A.	February 2nd, 1911	,, ,,
Fielding, Michael Angelo	December 15th, 1910	February 16th.
Gallsworthy, Benjamin	May 18th, 1911	June 15th.
Gardner, Edgar Harold	April 6th, 1911	,, ,,
Gardner, William Temple	December 1st, 1910	February 16th.
Gardthausen, Charles Christian	November 16th, 1911	December 7th.
Garner, John Henry, B.Sc.	,, 2nd, 1911	,, ,,
Gauge, Arthur Josiah Hoffmeister	October 19th, 1911	,, ,,
Gaunt, Rufus, M.Sc., Ph D.	November 2nd, 1911	,, ,,
Ghose, Joges Chandra, M.A.	May 4th, 1911	June 15th.
Giddy, Thomas Grantham	March 16th, 1911	May 4th.
Gonville, Cyril Herbert Koszelski	May 18th, 1911	June 15th.
Goold, Rowland Lewis	April 6th, 1911	,, ,,
Griffiths, Evan Dalton, B.Sc.	December 15th, 1910	February 16th.
Hall, Arthur Bennett	December 15th, 1910	February 16th.
Hall, Sydney, B.Sc.	October 19th, 1911	December 7th.
Hampshire, Charles Herbert, B.Sc.	December 15th, 1910	February 16th.
Harding, Henry George Alan	November 17th, 1910	,, ,,
Harwood, Henry Francis, M.Sc., Ph.D.	February 16th, 1911	May 4th.
Hill, James Hogan	November 16th, 1911	December 7th.
Hodgson, Cyril Vincent	October 19th, 1911	,, ,,
Hodsman, Henry James, M.Sc.	,, ,, ,,	,, ,,
Hogg, Alexander Frederick, M A.	,, ,, ,,	,, ,,
Horne, William Joseph Chetwynd	January 19th, 1911	February 16th.
Hough, Bernard Grindrod	December 15th, 1910	,, ,,
Hughes, Edwin Burnhope	March 2nd, 1911	May 4th.
Hurst, Reginald	January 19th, 1911	February 16th.
Jenkin, William Alfred	November 17th, 1910	February 16th
Joseph, Edward Lionel	April 6th, 1911	June 15th.
Khosla, Sant Ram	November 2nd, 1911	December 7th.
King, Harold, M.Sc.	,, ,, ,,	,, ,,
Laws, Ernyst Graham, B.A.	December 15th, 1910	February 16th.
Linenbröker, Henry Edmund	May 18th, 1911	June 15th.
Ling, Herbert James	,, 4th, 1911	,, ,,
Lucas, Thomas Riley	February 16th, 1911	May 4th.
McBain, James William, M.A., Ph.D.	January 19th, 1911	February 16th.
Martin, Geoffrey, M.Sc., Ph.D.	November 2nd, 1911	December 7th.
Merriman, Richard William, M.A.	April 6th, 1911	June 15th.
Messervy, Roney Forshaw	February 16th, 1911	May 4th.
Miller, John Watterson	November 17th, 1910	February 16th.
Mills, Robert	October 19th, 1911	December 7th.
Moore, Walter Roman	November 17th, 1910	February 16th.
Moullin, Oswald Mansell-, B.A.	February 2nd, 1911	May 4th.
Nath, Bhâgavatula Viswa	October 19th, 1911	December 7th.
Newton, Leonard Owen	March 2nd, 1911	May 4th.
Nilié-Martin, Gaston	November 16th, 1911	December 7th.

Name.	Proposed.	Elected.
Owen, Idris Larkby, M.Sc.	March 16th, 1911	May 4th.
Page, Harold James	December 1st, 1910	February 16th.
Parkes, Thomas Peers, B.Sc.	October 19th, 1911	December 7th.
Partington, Edward	January 19th, 1911	February 16th.
Pastfield, John Lawrence Robinson, B.A.	February 16th, 1911	May 4th.
Paul, Felix Gabriel	May 4th, 1911	June 15th.
Peacock, David Henry, B.A., B.Sc.	October 19th, 1911	December 7th.
Peddle, Cyril James, M.Sc.	January 19th, 1911	February 16th.
Penney, Richard Garnet	February 16th, 1911	May 4th.
Percival, George Arnliffe	,, 2nd, 1911	,, ,,
Pitt, Leonard Ison, B.Sc.	May 18th, 1911	June 15th.
Plews, Frank Henry	November 17th, 1910	February 16th.
Rao, B. Venkata, B.A.	October 19th, 1911	December 7th.
Raper, Henry Stanley	November 17th, 1910	February 16th.
Raymond, Percy James	June 1st, 1911	December 7th.
Reilly, Joseph, B.A.	October 19th, 1911	,, ,,
Richardson, John Ffraid	November 16th, 1911	,, ,,
Ridsdale, Noël Douglas	October 19th, 1911	,, ,,
Rivett, Albert Cherbury David, B.A., B.Sc.	February 2nd, 1911	May 4th.
Robison, Robert, Ph.D., B.Sc.	March 16th, 1911	,, ,,
Saville, William Bristow	October 19th, 1911	December 7th.
Scopes, Lionel Gowing-	June 15th, 1911	,, ,,
Smith, Bernard Charlie	October 19th, 1911	,, ,,
Smith, John Henry	,, ,, ,,	,, ,,
Stanford, Robert Viner, M.Sc., Ph.D.	December 1st, 1910	February 16th
Stokes, George Alfred	November 2nd, 1911	December 7th.
Summers, George Douglas	,, 17th, 1910	February 16th.
Thomson, David, M.A., B.Sc., Ph.D.	January 19th, 1911	February 16th.
Vakil, Kapibram Hardevram, B.A.	October 19th, 1911	December 7th.
Vanstone, Ernest, B Sc.	June 1st, 1911	,, ,,
Vassiliev, Alexey, Mïkhaïlovich	November 16th, 1911	,, ,,
Verschoyle, William Denham	January 19th, 1911	February 16th.
Vipond, Harry James, B.A.	October 19th, 1911	December 7th.
Walker, Eric Everard	March 2nd, 1911	May 4th.
Walton, William Keighley	May 4th, 1911	June 15th.
Watson, Henry Hough	March 2nd, 1911	May 4th.
Waygood, Bertie James	January 19th, 1911	February 16th.
Wheldon, Alfred Henry Finniss-	February 16th, 1911	May 4th.
Wilks, William Arthur Reginald, M.A.	,, 2nd, 1911	,, ,,
Wink, Ian Gordon Sellar	December 15th, 1910	February 16th.
Wishart, George, B.A.	June 15th, 1911	December 7th.
Wood, Edward Escott	January 19th, 1911	February 16th.
Wood, William	March 2nd, 1911	May 4th.
Wright, Ernest Walter	October 19th, 1911	December 7th.
Wright, Robert, M.A.	February 16th, 1911	May 4th.
Yates, Charles Fursdon	January 19th, 1911	February 16th.

LIST OT HONORARY AND FOREIGN MEMBERS ELECTED DURING 1911.

Name.	Proposed.	Elected.
Eugen Bamberger	February 16th, 1911	March 2nd.
Giacomo Ciamician	,, ,, ,,	,, ,,
Paul Heinrich Ritter von Groth	,, ,, ,,	,, ,,
John William Mallet	,, ,, ,,	,, ,,
Walther Nernst	,, ,, ,,	,, ,,

LIST OF FELLOWS DECEASED DURING 1911.

Name.	Elected.	Died.
* [1] Attfield, John	January 16th, 1862	March 18th, 1911.
Beanes, Edward	March 3rd, 1864	August 19th, 1911.
Braby, Frederic	April 15th, 1869	October 9th, 1911.
Brown, Joseph	March 16th, 1882	June 2nd, 1911.
*Buch, Carl von	June 21st, 1877	April 23rd, 1911.
Collens, Edward	November 6th, 1873	April 12th, 1911.
Cooper, Albert	January 17th, 1889	August 19th, 1911.
Darby, Stephen	November 15th, 1852	December 21st, 1911.
*Davis, Richard Hayton	June 6th, 1872	June 2nd, 1911.
Ferrier, John Greig	May 4th, 1905	February 14th, 1911.
Forbes, James	November 19th, 1874	March 14th, 1911.
Harrison, Albert	May 17th, 1888	August 28th, 1911.
Hoit, Alfred Henry	February 17th, 1904	December 22nd, 1911.
Hudson, William	February 21st, 1878	February 23rd, 1911.
Kinnicutt, Leonard Parker	December 5th, 1895	February 6th, 1911.
Knight, Frederick Charles	June 20th, 1889	February 12th, 1911.
Lyon, Isidore Bernadotte	May 1st, 1873	April 27th, 1911.
McCowan, William	February 4th, 1875	March 4th, 1911.
* [2] Maskelyne, Mervyn Herbert Nevil Story	June 2nd, 1851	May 20th, 1911.
*Muter, John	November 3rd, 1870	December 19th, 1911
*Nevile, Ralph Henry Christopher	April 4th, 1878	March 9th, 1911.
Orme, Temple Augustus	November 4th, 1869	April 4th, 1911.
Ross, Lewis Buttle	February 17th, 1870	December 5th, 1911.
Sadler, Sir Samuel	June 18th, 1868	September 29th, 1911.
Sharp, James	June 18th, 1885	May 11th, 1911.
Smith, Harry Wood	February 6th, 1890	February 10th, 1911.
Walker, James Samuel Hourston	April 17th, 1890	November 19th, 1910.
Whitehouse, William	December 5th, 1889	June 16th, 1911.
Williams, William	December 15th, 1892	February 16th, 1911.
*Winterson, William George	December 3rd, 1908	May 18th, 1911.

LIST OF HONORARY AND FOREIGN MEMBERS DECEASED DURING 1911.

van't Hoff, Jacobus Heinricus	February 2nd, 1888	March 1st, 1911.
Ladenburg, Albert	,, ,, ,,	August 15th, 1911.
Spring, Walthère	January 20th, 1898	July 17th, 1911.
Troost, Louis Joseph	,, ,, ,,	September 30th, 1911

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* Trans.

[1] C. 1874–8.

[2] C. 1858–9; 1875–7. V.P. 1878–81.

TITLES OF PAPERS COMMUNICATED TO THE SOCIETY DURING 1911.

	Page in Proceedings.	Page in Transactions.
January 19*th*.		
1. The interaction of alloxan and glycine. By William Holdsworth Hurtley and William Ord Wootton	2	288
2. Intramolecular rearrangements of diphenylmethane *o*-sulphoxide. By Thomas Percy Hilditch and Samuel Smiles	3	145
3. The reactions between chemical compounds and living muscle-proteins. By Victor Herbert Veley	3	180
4. The decomposition of tetramethylammonium nitrite by heat. By Prafulla Chandra Rây and Hemendra Kumar Sen...	4	—
5. Influence of minute quantities of ferric salts and of manganese nitrate on the rate of solution of mercury in nitric acid. By Prafulla Chandra Rây	4	1012
6. On *dl*- and d-Δ^2-m-menthenol(8) and *dl*- and d-$\Delta^{2:8(9)}$-m-menthadiene. By Walter Norman Haworth, William Henry Perkin, jun., and Otto Wallach	4	118
7. The identity of xanthaline and papaveraldine. By Bessie Dobson and William Henry Perkin, jun.	4	135
8. Amalgams containing silver and tin. By Reginald Arthur Joyner	5	195
9. Studies of the constitution of soaps in solution. The electrical conductivity of sodium stearate solutions. By Richard Charles Bowden	5	191
10. Additive compounds of phenols and phenolic ethers with aromatic polynitro-derivatives. By John Joseph Sudborough and Stanley Hoskings Beard......	5	209
11. The effect of contiguous unsaturated groups on optical activity. Part VI. The influence of the carbonyl group on optical rotatory power. Part VII. The relative influences of aromatic and hydroaromatic nuclei on optical rotatory power. Part VIII. The influence on optical activity of two contiguous unsaturated groups in comparison with that of one unsaturated group at varying distances from the optically active complex. By Thomas Percy Hilditch	6	224
12. The relative effects of ethylenic and acetylenic linkings on optical rotatory power. By Thomas Percy Hilditch	6	218
13. The direct action of radium on ammonia. By Edgar Philip Perman	7	132
14. Cupritartrates and analogous compounds. By Spencer Umfreville Pickering..	7	169

	Page in Proceedings.	Page in Transactions.
15. Molecular association in water. By Cyril James Peddle and William Ernest Stephen Turner	8	685
16. Note on the preparation of thiobenzanilide. By Edward de Barry Barnett	8	—
17. Organic derivatives of silicon. Part XIV. The preparation of tertiary silicols. By Frederic Stanley Kipping and John Edward Hackford	8	138
18. *o*-Carboxyanilides of the sugars. By James Colquhoun Irvine and Alexander Hynd	9	161
19. The iodobenzenemonosulphonic acids. Part III. 2 : 3-Di-iodo- and 2 : 3 : 4 : 5-tetraiodo-benzenesulphonic acids. By Mary Boyle	9	325
20. Occurrence of pentathionic acid in natural waters. By James Scott Maclaurin	10	—
21. β-Methyl-$\Delta^{\alpha\lambda}$-dodecadiene and β-methyl-$\Delta^{\alpha\gamma}$-decadiene. By Victor John Harding, Gertrude Maud Walsh, and Charles Weizmann	12	448
22. Determination of the vapour pressures of hydrates by a dynamical method. (Preliminary note.) By James Riddick Partington	12	—
23. A simple demonstration of Gibbs's phase rule. By James Riddick Partington	13	—
24. Cholesterol and fatty acids. By James Riddick Partington	14	313
25. Salts of the dinitrodihydroxybenzenes. By William Bayliss Shaw	14	—
Febuary 2nd.		
26. The constancy of water of crystallisation in hydrated salts. Part I. By Herbert Brereton Baker and George Henry Joseph Adlam	17	507
27. The triazo-group. Part XVI. Interaction of nitrosates and sodium azide. By Martin Onslow Forster and Frederik Marinus van Gelderen	19	239
28. The triazo-group. Part XVII. Nitroso-azides of pinene and terpineol. By Martin Onslow Forster and Sidney Herbert Newman	19	244
29. The synthesis of 3-β-aminoethylindole. By Arthur James Ewins	20	270
30. The orientation of the nitro-group in nitromyristicinic acid. By Arthur Henry Salway	20	266
31. The condensation of aromatic aldehydes with nitromethane. By Frederic George Percy Remfry	20	282
32. The phosphoric acids. By Alfred Holt and James Eckersley Myers	21	384
33. The determination of solubility coefficients by aspiration. By William Jacob Jones	21	392
34. α-Amino-α-phenylacetamide and some of its derivatives. By Charles Hugh Clarke and Francis Francis	22	319
35. Methylammonium nitrite. By Prafulla Chandra Rây and Jitendra Nath Rakshit	22	1016

	Page in Proceedings.	Page in Transactions.
36. The picraminobenzoic acids and their salts. By James Codrington Crocker and Frank Matthews	22	301
37. New derivatives of *d*-glucosamine. By James Colquhoun Irvine, David McNicoll, and Alexander Hynd	23	250
38. The interaction of silver nitrate and potassium persulphate and its catalytic effect in the oxidation of organic substances. By Percy Corlett Austin	24	262
39. The isomerism of ferrocyanides. By Samuel Henry Clifford Briggs	24	1019

February 16*th.*

	Page in Proceedings.	Page in Transactions.
40. Different methods of applying the Grignard reagents. By Harold Davies and Frederic Stanley Kipping	39	296
41. Molecular association and its relationship to electrolytic dissociation. The molecular complexity of halogen-containing compounds. By William Ernest Stephen Turner	40	880
42. α-*p*-Hydroxy-*m*-methoxyphenylethylamine, and the resolution of α-*p*-hydroxyphenylethylamine. By Charles Watson Moore	42	416
43. The formation and reactions of imino-compounds. Part XV. The production of imino-derivatives of piperidine leading to the formation of the ββ-disubstituted glutaric acids. By Ferdinand Bernard Thole and Jocelyn Field Thorpe	42	422
44. The interaction of copper und nitric acid in presence of metallic nitrates. Part II. By Edward Henry Rennie and William Ternent Cooke	42	1035
45. The mechanism of Doebner and von Miller's quinaldine synthesis. By Humphrey Owen Jones and Percy Edwin Evans	43	334
46. A synthesis of derivatives of phenothioxin. By Thomas Percy Hilditch and Samuel Smiles	44	408
47. The nitration of acetylbenzoin and of stilbenediol diacetates. By Arthur Gordon Francis and Charles Alexander Keane	44	344
48. Experiments on the formation of 4(or 5)-β-aminoethylglyoxaline from histidine. By Arthur James Ewins and Frank Lee Pyman	45	339
49. The dissociation of cupric bromide, and some forms of glass manometer. By Colin Gyrth Jackson	45	1056
50. The determination of the dissociation pressures of hydrated salts by a dynamical method. By James Riddick Partington	45	466
51. The influence of conjugated linkings on general absorptive power. Part I. The absorption spectra of some benzene derivatives. By Cecil Reginald Crymble, Alfred Walter Stewart, Robert Wright, and William Gerald Glendinning	46	451

	Page in Proceedings.	Page in Transactions.
52. The optical properties of acids containing an asymmetric quaternary carbon atom. Part I. The synthesis of β-phenyl-β-methylvaleric acid and of *as*-methylethylsuccinic acid. By John Kenneth Harold Inglis	46	538

March 2nd.

	Page in Proceedings.	Page in Transactions.
53. Studies in the camphane series. Part XXIX. A new phenylhydrazone of camphorquinone. By Martin Onslow Forster and Adolf Zimmerli	50	478
54. Fluorone derivatives. By Frank George Pope and Hubert Howard	52	545
55. The constituents of *Withania somnifera*. By Frederick Belding Power and Arthur Henry Salway	53	490
56. The carbohydrate constituents of Pára rubber: separation of *l*-methylinositol. (Preliminary note.) By Samuel Shrowder Pickles and Bernard Wyndham Whitfeild	54	—
57. Potassium cupricarbonates. By S. U. Pickering	55	800
58. Synthesis of dipeptides of α-aminolauric acid with glycine, alanine, valine, leucine, and asparagine. By Arthur Hopwood and Charles Weizmann	55	571
59. The occlusion of hydrogen by the palladium-gold alloys. By Arthur John Berry	56	463
60. Synthesis of *dl*-3 : 4-dihydroxyphenylalanine. By Casimir Funk	56	554
61. The interaction of chlorine and carbon monoxide. (Preliminary note.) By David Leonard Chapman and Frank Houghton Gee	56	—
62. Experiments on the synthesis of the terpenes. Part XVI. Resolution of *dl*-1-methyl-Δ^3-*cyclo*hexene-3-carboxylic acid. Synthesis of the *d*- and *l*-modification of Δ^3-*m*-menthenol(8) and $\Delta^{3:8(9)}$-*m*-menthadiene. By Bernard Dunstan Wilkinson Luff and William Henry Perkin, jun.	57	518
63. Experiments on the synthesis of the terpenes. Part XVII. *d*-Δ^3-*p*-menthenol(8) and *d*-$\Delta^{3:8(9)}$-*p*-menthadiene. By Tsan Quo Chou and William Henry Perkin, jun.	57	526
64. Some derivatives of *o*-veratraldehyde. (Preliminary note.) By William Henry Perkin, jun., Walter Morrell Roberts, and Robert Robinson	57	—
65. *iso*Oxyberberine. (Preliminary note.) By Norman Bland, William Henry Perkin, jun., and Robert Robinson	59	—
66. The application of viscometry to the measurement of rate of reaction. By Albert Ernest Dunstan and Albert George Mussell	59	565
67. The action of hydrogen sulphide on the alkyloxides of the metals. Part I. Sodium and potassium ethoxides. By Alexander Rule	60	558

	Page in Proceedings.	Page in Transactions.
68. Simple method of decomposing refractory tin ores. By Herbert Yabsley Loram	60	—

March 16*th.*

	Page in Proceedings.	Page in Transactions.
69. Apparatus for the maintenance of constant pressures above and below the atmospheric pressure. Application to fractional distillation. By John Wade and Richard William Merriman	64	984
70. The influence of water on the boiling point of ethyl alcohol at pressures above and below the atmospheric pressure. By John Wade and Richard William Merriman	65	997
71. The interaction of aromatic disulphides and sulphuric acid. By William George Prescott and Samuel Smiles	65	640
72. The absorption spectra of permanganates in certain solvents. By Thomas Ralph Merton	66	637
73. The resolution of asymmetrical derivatives of phosphoric acid. By Frederic Stanley Kipping and Frederick Challenger	66	626
74. The action of carbon dioxide in the bleaching process. By Sidney Herbert Higgins	67	858
75. The relation between the absorption spectra of metallic ions and their valency. (Preliminary note.) By Cecil Reginald Crymble	68	—
76. The element $\mathrm{Cu} \mid \mathrm{Cu_2O}$ alkali $\mid \mathrm{H_2}$ at 0°. By Arthur John Allmand	69	840
77. A standard electrode with alkaline electrolyte: $\mathrm{Hg} \mid \mathrm{HgO}$ alkali. By Frederick George Donnan and Arthur John Allmand	70	845
78. The volatile constituents of coal. Part II. By Maurice John Burgess and Richard Vernon Wheeler	70	649
79. The absorption spectra of chlorobenzene and bromobenzene as vapours, as liquids, and in solution. By John Edward Purvis	71	811
80. Orthophosphoric acid as a dehydrating catalytic agent. Part I. The condensation of acetone in presence of phosphoric acid. By Pañchānan Neogi	71	1249
81. Trialkylammonium nitrites and nitrites of the bases of the pyridine and quinoline series. Part I. By Pañchānan Neogi	71	1252
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ADDITIONS TO THE LIBRARY DURING THE YEAR 1911.

Abegg, *Richard.* Chemische Affinität, Valenz und das natürliche System der Elemente. (From "Scientia," 1910, **8**.)

Accum, *Fredrick.* Description of the process of manufacturing coal gas, . . . with elevations, sections and plans. pp. xvi + 334. ill. London 1819. (*Reference.*)

Allen, *Alfred Henry.* Commercial organic analysis. Vols. IV. and V. 4th edition. Edited by *W. A.* **Davis** and *Samuel S.* **Sadtler.** pp. viii + 466, ix + 704. ill. London 1911.

Anschütz, *Richard.* See **Richter**, *Victor von.*

Artephius. See **Salmon**, *William.*

Autenrieth, *Wilhelm*, and **Tesdorpf**, *Theodor.* Über eine kolorimetrische Bestimmung des Traubenzuckers im Harn. (From the *Münch. med. Woch.*, 1910, **37**.)

Avogadro, *Amedeo.* Opere scelte. Pubblicate dalla R. Accademia delle Scienze di Torino. pp. cxl + 491. Portrait. Torino 1911. (*Reference.*)

Backer, *Hilmar Johannes.* De Nitraminen en hunne electrochemische reductie tot Hydrazinen. pp. xv + 242. Leiden 1911.

Bacon, *Roger.* See **Salmon**, *William.*

Bacon, *William N.* See **Cross**, *Charles Frederick.*

Bang, *Ivar.* Chemie und Biochemie der Lipoide. pp. xi + 187. Wiesbaden 1911.

Barlow, [*Peter*]. Barlow's Tables of squares, cubes, square roots, cube roots, reciprocals of all integer numbers up to 10,000. Stereotype edition, examined and corrected. pp. viii + 200. London 1840.

Barthel, *Chr.* Methods used in the examination of milk and dairy products. Translated by *W.* **Goodwin.** pp. xi + 260. ill. London 1910.

Beck, *Karl*, and **Stegmüller**, *Ph.* Über die Löslichkeit von Bleisulfat und Bleichromat für sich, in Gemischen und in Form von Ölfarben in verdünnter Salzsäure, sowie über das Gleichgewicht von Chromat und Bichromat in Lösung. (From the *Arb. K. Gesundh.-Amt*, 1910, **34**.)

Bemmelen, *Jakob Maarten van.* Gedenkboek aangeboden aan J. M. van Bemmelen, 1830–1910. pp. xxix + 461. Helder 1910.

Berzelius, *Jöns Jacob.* Essai sur la théorie des proportions chimiques et sur l'influence chimique de l'électricité. Traduit du Suédois. pp. xvi + 190 + [ii] + 120 + [ii]. Paris 1819.

Bevan, *Edward John.* See **Cross,** *Charles Frederick.*

Beveridge, *Wilfred William Ogilvy.* A report on the determination of the amount of tin in tinplate used for canning preserved food. (From the *J. Roy. Army Med. Corps*, 1911.)

Biéchy, *Theodor.* See **Heiduschka,** *Alfred.*

Bingham, *Eugene C.*, and **White,** *George F.* Laboratory manual of inorganic chemistry. pp. viii + 146. New York 1911.

Birch, *Thomas.* The life of the Honourable Robert Boyle. pp. [iv] + 458 + [xvi]. London 1744.

Blount, *Bertram,* and **Bloxam,** *Arthur George.* Chemistry for engineers and manufacturers. 2nd edition. 2 vols. pp. xii + 392, xv + 513. ill. London 1911, 1910.

Bloxam, *Arthur George.* See **Blount,** *Bertram.*

Blücher, *H.* Modern industrial chemistry. Translated by *J. P.* **Millington.** pp. xvi + 779. ill. London 1911. (*Reference.*)

Bock, *Johannes.* Über die Ausscheidung der Alkalimetalle bei der Purindiurese. (From the *Skand. Arch. Physiol.*, 1911, **25.**)

Böttger, *Wilhelm.* Stand und Wege der analytischen Chemie. (Die chemische Analyse, Vol. XIII.) Stuttgart 1911.

Bokorny, *Th.* See **Loew,** *Oscar.*

Bothamley, *Charles Herbert.* The Ilford manual of photography. pp. vi + 218. ill. Ilford. n.d.

Boyle, *Robert.* Philosophical works, Abridged . . . by *Peter* **Shaw.** 2nd edition, corrected. 3 vols. pp. [iv] + xliii + 730, xx + 726, [iv] + xv + iv + 756. ill. London 1738.

—— See **Birch,** *Thomas.*

Braccesco, *Giovanni.* La espositione di Geber Filosofo . . . , nella quale si dichiarano molti nobilissimi secreti della Natura. In Vinegia appresso Gabriel Giolito dé Ferrari 1562. pp. 160. (*Reference.*)

Brauns, *Dirk Hendrik.* Theory of the rotation of the plane of polarisation. pp. 21. Detroit 1911.

Cain, *John Cannell.* See **Roscoe,** *The Right Honourable Sir Henry Enfield.*

Calliess, *Franz Wilhelm.* Über Ephedrin und Pseudoephedrin. (From the *Apoth. Zeit.*, 1910, **25.**)

Carnot, *Adolphe.* Traité d'analyse des substances minérales. Vol. III. pp. 903. Paris 1910.

Carré, *P.* Hydrocarbures, alcools et éthers de la série grasse. pp. 410. Paris 1911.

Castell-Evans, *John.* Physico-chemical tables. Vol. II. Physical and analytical chemistry. pp. xiv + 549 to 1235. London 1911.

Chalon, *Paul F.* Les explosifs modernes. 3rd edition. pp. vi + 789. Paris 1911.

Civetta, *Angelo.* See **Prandi**, *Oreste.*

Clacher, *William.* Some notes on animal charcoal. (From the *Int. Sugar J.*, 1910.)

—— The manufacture of carbons. (From the *Electrical Review*, 1911, **68**.)

Clowes, *Frank*, and **Coleman**, *Joseph Bernard.* Quantitative chemical analysis. 9th edition. pp. xxiv + 565. ill. London 1911.

Coleman, *Joseph Bernard.* See **Clowes**, *Frank.*

Comanducci, *Ezio.* Die Konstitution der Chinaalkaloide. (Sammlung, Vol. XVI.) Stuttgart 1911.

—— Tallochinina. pp. 7. Napoli 1910.

Contino, A. Sulla quantità di manganese in alcuni terreni Italiani. (From the *Staz. sper. agrar. ital.*, 1911, **44**.)

Coventry, *Bernard.* Report on the progress of agriculture in India for 1909–10. pp. 106. Calcutta 1911.

Cross, *Charles Frederick*, **Bevan**, *Edward John*, **Sindall**, *Robert Walter*, and **Bacon**, *William N.* Wood pulp and its uses. pp. xi + 270. ill. London 1911.

Davies, *Samuel Henry.* See **Jörgensen**, *Alfred.*

Davis, *William Alfred.* See **Allen**, *Alfred Henry.*

Davy, *Sir Humphry.* See **Paris**, *John Ayrton.*

Decker, *Herman.* See **Graebe**, *Carl.*

Desch, *Cecil Henry.* Chemistry and testing of cement. pp. xi + 287. ill. London 1911.

Dibdin, *William Joseph.* Notes of lecture on mortar and cement. pp. 32. London 1911.

Dictionary (**An explanatory**) of the apparatus and instruments employed in the various operations of philosophical and experimental chemistry. With seventeen quarto copper-plates. By a Practical Chemist. pp. vii + 296. London 1824.

Dunstan, *Albert Ernest*, and **Thole**, *Ferdinand Bernard.* Textbook of practical chemistry for technical institutes. pp. viii + 335. ill. London 1911.

Dyer, *Bernard*, and **Shrivell**, *F. W. E.* The manuring of market garden crops. pp. 144. ill. London 1910.

Edge, *John Harold.* Notes on practical cotton finishing. pp. 103. ill. London 1911.

Espagnet, *Joannes d'*. Das Geheime Werck der Hermetischen Philosophie, Worinnen die natürlichen und künstlichen Geheimnüsse der Materie des Philosophischen Steins, wie auch die Art und Weise zu arbeiten richtig und ordendlich offenbahret sind. pp. [xii] + 90. [Wanting pp. 37–38, 71–72 and 87–88.] Leipzig 1685. (*Reference.*)

Fagan, *Thomas Wallace*. See **Lauder**, *Alexander*.

Fischel, *Richard*. Der histochemische Nachweis der Peroxydase. (From the *Wien. klin. Woch.*, 1910, **23**.)

Fischer, *Ferdinand*. Kraftgas, seine Herstellung und Beurteilung. pp. viii + 236. ill. Leipzig 1911.

Flamel, *Nicolas*. See **Salmon**, *William*.

Forssner, *Gunnar*. Über die Einwirkung des Nahrungsfettes auf die Acetonkörperausscheidung. (From the *Skand. Archiv. Physiol.*, 1910, **23**.)

Fouard, *Eugène*. L'état colloïdal de l'amidon et sa constitution physicochimique. pp. 147. Laval 1911.

Fowler, *Gilbert John*. An introduction to bacteriological and enzyme chemistry. pp. viii + 328. ill. London 1911.

Friedheim, *Carl*. See **Gmelin**, *Leopold*.

Friend, *John Albert Newton*. Elementary domestic chemistry. pp. x + 180. ill. London 1911.

—— The corrosion of iron and steel. pp. xiv + 300. London 1911.

Gabb, *George Hugh*. A recently discovered portrait of Dr. Jeffries, by J. Russell, R.A. (From the *Connoisseur*, 1911, **29**.)

Gaebel, *Gustav Otto*. Das Reischauersche Titrationsverfahren zur Bestimmung des Harnzuckers. (From the *Apoth. Zeit.*, 1910, **25**.)

Gallerani, *Guido Tartarini*. See **Venturoli**, *Giuseppe*.

Gault, *H.* See **Richter**, *Victor von*.

Gazzetti, *C.*, and **Sarti**, *C.* Intorno ad una reazione rossa del reattivo di Esbach. (From the *Arch. farm. sperim. Sci.*, 1910, **9**.)

Geber, See **Braccesco**, *Giovanni*.

—— See **Salmon**, *William*.

Gildemeister, *Eduard*, and **Hoffmann**, *Friedrich*. Die ätherischen Öle. 2nd edition. Vol. I. pp. viii + 697. Leipzig 1910.

Glikin, *W.* Kalorimetrische Methodik. Ein Leitfaden zur Bestimmung der Verbrennungswärme organischer Körper, einschliesslich Nahrungsstoffe und Stoffwechselprodukte und zur Messung der tierischen Wärmeproduktion. pp. vii + 208. ill. Berlin 1911.

Gmelin, *Leopold*, and **Kraut**, *Karl Johann*. Handbuch der anorganischen Chemie. 7th edition. Edited by **Friedheim**, *Carl*, and **Peters**, *Franz*. Vol. I., etc. Heidelberg 1905 + . *Reference.*

Goldschmidt, *F.* See **Ubbelohde**, *L.*

Goodwin, *W.* See **Barthel**, *Chr.*

Graebe, *Carl*. Untersuchungen über Chinone. Edited by *Herman* **Decker**. pp. viii + 672. Portraits. Leipzig 1911. (*Reference*.)

Gray, *George*. On the dissolved matter contained in rain water collected at Lincoln, New Zealand. (From the *Canterbury Agric. Coll. Mag.*, 1910).

Gredinger, *Wilhelm*. See **Stift**, *Anton*.

Gross, *Oscar*. Untersuchungen über das Verhältniss von Stickstoff zu Schwefel im Stoffwechsel. (From the *Zeitsch. exp. Path. Ther.*, 1911, **9**.)

H., *J.* See **Valentinus**, *Basilius*.

Hämäläinen, *Juho*. Über das Schicksal des Cineols (Eukalyptols) im Organismus. (From the *Skand. Arch. Physiol.*, 1910, **24**.)

Hämäläinen, *Juho*, and **Sjöström**, *Lennart*. Über den Umfang der Glykuronsäurepaarung bei enzymimmunisierten Kaninchen. (From the *Skand. Arch. Physiol.*, 1910, **24**.)

Hall, *William T.* See **Ostwald**, *Wilhelm*.

Harbord, *Frank William*. See **Roberts-Austen**, *Sir William Chandler*.

Harden, *Arthur*. Alcoholic fermentation. pp. ix + 128. London 1911.

—— See **Roscoe**, *The Right Honourable Sir Henry Enfield*.

Hedley, *Edgar Percy*. See **Werner**, *A.*

Heiduschka, *Alfred*, and **Biéchy**, *Theodor*. Bestimmung des Arsens im Harn nach Anwendung von Salvarsan. (From the *Apoth. Zeit.*, 1911.)

Henderson, *Velyen E.* Hemmung der Wirkung chemischer Muskelreize durch Anelektrolyte. (From the *Zentr. Physiol.*, 1910, **24**.)

Hermes Trismegistus. See **Salmon**, *William*.

Higgins, *William*. An essay on the theory and practice of bleaching, wherein the sulphuret of lime is recommended as a substitute for pot-ash. pp. xxxii + 71. London 1799.

Hilditch, *Thomas Percy*. A concise history of chemistry. pp. ix + 263. London 1911.

Höber, *Rudolf*. Physikalische Chemie der Zelle und der Gewebe. 3rd edition. pp. xv + 671. Leipzig 1911.

Hoffmann, *Friedrich*. See **Gildemeister**, *Eduard*.

Hopkins, *Cyril George*. Soil fertility and permanent agriculture. pp. xxiii + 653. ill. Boston 1910.

Houston, *A. C.* See **Metropolitan Water Board**.

Huppert, *Karl Hugo*. See **Neubauer**, *Carl Theodor Ludwig*.

Indian Guild of Science and Technology. Year Book 1911. pp. 135. ill. Letchworth 1911.

International Congress of Applied Chemistry, VII. London, 1909. [Proceedings, etc.] 18 vols. London 1910. (*Reference*).

Jago, *William*, and **Jago**, *William C.* The technology of bread-making. Including the chemistry and analytical and practical testing of wheat, flour, and other materials employed in bread-making and confectionery. pp. viii + 908. ill. London 1911.

Javillier, *M.* Sur les silicotungstates de conicine, de spartéine et d'atropine. (From the *Bull. Sci. Pharm.*, 1910, **17**.)

Jörgensen, *Alfred.* Micro-organisms and fermentation. Translated by *Samuel Henry* **Davies**. 4th edition. pp. xi + 489. London 1911

Kalid Ben Jazichi. See **Salmon**, *William.*

Keane, *Charles Alexander.* See **Lunge**, *George.*

Kinoshita, *Tosaku.* Über das Auftreten und die quantitative Bestimmung des Trimethylamins im menschlichen Harn. (From the *Zentr. Physiol.*, 1910, **24**.)

Knecht, *Edmund*, **Rawson**, *Christopher*, and **Loewenthal**, *Richard.* A manual of dyeing. 2nd edition. 2 vols. pp. xii + 902. ill. London 1910.

Körner, *Wilhelm.* Über die Bestimmung des chemischen Ortes bei den aromatischen Substanzen. (Ostwald's *Klassiker*, No. 174.) Leipzig 1910.

Kopp, *Hermann.* Die Entwickelung der Chemie in der neuren Zeit. pp. xxii + 854. München 1873.

Kraft, *F.* Die Glykoside der Blätter der Digitalis purpurea. (From the *Schweiz. Wochensch. Chem. Pharm.*, 1911.)

Lange, *Hans.* Studien über die Zusammensetzung heliumführender Mineralien. (From the *Zeitsch. Naturwiss. Halle*, 1910, **82**.)

Lauder, *Alexander, and* **Fagan**, *Thomas Wallace.* The variation in the composition of milk. Fifth annual report. pp. 42. Edinburgh 1911.

Lavoisier, *Antoine Laurent.* Traité élémentaire de chimie, présenté dans un ordre nouveau et d'après les découvertes modernes. 2nd edition. pp. xliv + 322, viii + 327. Paris 1793.

Lewis, *Samuel Judd.* Studien über das elementare Zirkonium. pp. 77. Stuttgart 1910.

Ley, *H.* Die Beziehungen zwischen Farbe und Konstitution bei organischen Verbindungen. Unter Berücksichtigung der Untersuchungsmethoden. pp. viii + 246. ill. Leipzig 1911.

Local Government Board. Reports of Inspector of Foods. Nos. 1 to 16. London 1906–1911. (*Reference.*)

Loew, *Oscar.* Über die physiologische Rolle der Kalziumsalze. (From the *Münch. Med. Woch.* 1910.)

Loew, *Oscar*. Über die Wirkung von Strontiumsalzen auf Algen. (From *Flora*, 1911, **102**.)

Loew, *Oscar*, and **Bokorny**, *Th.* Aktives Eiweiss und Tannin in Pflanzenzellen. (From *Flora*, 1911, **102**.)

Loewenthal, *Richard*. See **Knecht**, *Edmund*.

Lunge, *George*. [Editor.] Technical methods of chemical analysis. English translation from the latest German edition, adapted to English conditions of manufacture, edited by *Charles Alexander* **Keane**. Vol. II, in two parts. pp. xxvii + 1252. ill. London 1911.

—— The manufacture of sulphuric acid and alkali, with the collateral branches. Vol. III. Ammonia-soda, various processes of alkali making and the chlorine industry. 3rd edition. pp. xix + 764. London 1911.

Martindale, *W. Harrison*, and **Westcott**, *W. Wynn*. "Salvarsan" or "606" (Dioxy-diamino-arsenobenzol). Its chemistry, pharmacy, and therapeutics. pp. xv + 77. London 1911.

Masoni, *Giulio*. Saggio sull' azione del solfato di Manganese in rapporto alla vegetazione. (From the *Staz. sper. agrar. ital.*, 1911, **44**.)

Mastin, *John*. The chemistry, properties and tests of precious stones. pp. vi + 114. London 1911.

May, *Percy*. The chemistry of synthetic drugs. pp. xiii + 229. London 1911.

Meldola, *Raphael*. Evolution: Darwinian and Spencerian. The Herbert Spencer Lecture . . . 1910. pp. 44. Oxford 1910.

Mennicke, *Hans*. Die Metallurgie des Wolframs mit besonderer Berücksichtigung der Elektrometallurgie sowie der Verbindungen und Legierungen des Wolframs samt seinen Verwendungen. pp. ii + 416. ill. Berlin 1911.

Menschutkin, *Boris N.* Life and work of N. A. Menschutkin. pp. viii + 376. ill. 1908. [In Russian.]

Menschutkin, *Nikolai Alexandrovich*. See **Menschutkin**, *Boris N.*

Metropolitan Water Board, Sixth Report on research work. By *A. C.* **Houston**. pp. 18. London 1910.

Miculicich, *Miroslav*. Über den Einfluss von Elektrolyten und Anelektrolyten auf die Permeabilität der roten Blutkörperchen. From the *Zentr. Physiol.*, 1910, **24**.)

Millington, *J. P.* See **Blücher**, *H.*

Mingaye, *John C. H.*, and **White**, *Harold P.* Analyses of artesian and sub-artesian waters in New South Wales. pp. 8. Sydney 1911.

Mitchell, *Charles Ainsworth*. See **Simmons**, *William Herbert*.

Moreau, *B.* Analyse qualitative d'une mélange de sels, de recherche particulièrement difficile. (From the *Bull. Sci. Pharm.*, 1910.)

Müller, *Ernst Wolfgang*. See **Zeitschrift für angewandte Chemie**.

Nernst, *Walter*. Theoretical chemistry from the standpoint of Avogadro's rule and thermodynamics. Revised in accordance with the sixth German edition by *Henry Thomas* **Tizard**. pp. xix + 810. London 1911.

Neubauer, *Carl Theodor Ludwig*, and **Huppert**, *Karl Hugo*. Analyse des Harns. 11th edition. 1st half. pp. xiv + 682. ill. Wiesbaden 1910.

Nikaido, *Y*. Beet-sugar making and its chemical control. pp. xii + 354. ill. Easton, Pa. 1909.

Ostwald, *Wilhelm*. Introduction to chemistry. Authorized translation by *William T*. **Hall** and *Robert S*. **Williams**. pp. ix + 368. ill. New York 1911.

Ostwald's Klassiker. See **Kōrner**, *Wilhelm*.

Paderi, *Cesare*. Richerche sulle proprietà biologiche dell' acido glicuronico. I. (From the *Arch. Farm. sperim. Sci.*, 1911, **11**.)

Paris, *John Ayrton*. The life of Sir Humphry Davy. 2 vols. pp. xvi + 416, viii + 463. London 1831.

Partington, *J. Riddick*. Higher mathematics for chemical students. pp. iv + 272. London 1911.

Pellatt, *Apsley*. Curiosities of glass-making. With details of the processes and productions of ancient and modern ornamental glass manufacture. pp. vi + 146. ill. London 1849.

Peters, *Franz*. See **Gmelin**, *Leopold*.

Philippine Islands. The mineral resources of the Philippine Islands. With a statement of the production of commercial mineral products during the year 1909. pp. 81. ill. Manila 1910.

Piccinini, *Guido M*. Il metabolismo del manganese e la legge del minimo tra manganese e ferro. (From the *Arch. Farm. sperim. Sci.*, 1910, **10**.)

—— Il manganese come attivatore o cinasi non specifica e il Manganese colloidale. (From the *Biochem. Terap. sperim.*, 1910, **2**.)

Pohl, *Julius*. Experimenteller Beitrag zum Oxalsäurestoffwechsel. (From the *Zeitsch. exp. Path.*, 1910, **8**.)

Prandi, *Oreste*, and **Civetta**, *Angelo*. Il manganese nel vino. (From the *Staz. sper. agrar. ital.*, 1911, **44**.)

Pusa Agricultural Research Institute and College. Report 1909–10. pp. 69. Calcutta 1910.

Queensland, Report of the Agricultural Chemist for the year ending 30th June, 1910. pp. 23. Brisbane 1910.

Rankin, *George A*. See **Shepherd**, *Ernest S*.

Rassow, *Berthold*. See **Zeitschrift für angewandte Chemie**.

Rawson, *Christopher*. See **Knecht**, *Edmund*.

Redgrove, *Herbert Stanley.* Alchemy: ancient and modern. Being a brief account of the alchemistic doctrines, and their relations, to mysticism on the one hand, and to recent discoveries in physical science on the other hand; together with some particulars regarding the lives and teachings of the most noted alchemists. pp. xiv + 141. ill. London 1911.

—— On the calculation of thermo-chemical constants. pp. viii + 102. London 1909.

Redwood, *Sir Boverton.* Petroleum. A treatise on the geographical distribution and geological occurrence of petroleum and natural gas; the physical and chemical properties, production, and refining of petroleum and ozokerite; the characters and uses, testing, transport, and storage of petroleum products; and the legislative enactments relating thereto; together with a description of the shale oil and allied industries; and a full bibliography. 2 vols. pp. xxxii + 1064. ill. London 1906.

Richter, *Victor von.* Traité de chimie organique. Edited by *R.* **Anschütz** and *G.* **Schrœter.** Translated into French by *H.* **Gault.** Vol. I. pp. xxiv + 886. Paris 1910.

Rideal, *Samuel.* Disinfection and the preservation of food. Together with an account of the chemical substances used as antiseptics and preservatives. 3rd edition. pp. xii + 494. ill. London 1903.

Roberts-Austen, *Sir William Chandler.* An introduction to the study of metallurgy. 6th edition, revised and enlarged by *F. W.* **Harbord.** pp. xv + 478. ill. London 1910.

Roscoe, *The Right Honourable Sir Henry Enfield*, and **Harden,** *Arthur.* Inorganic chemistry for advanced students. 2nd edition. pp. viii + 476. ill. London 1910.

Roscoe, *The Right Honourable Sir Henry Enfield*, and **Schorlemmer,** *Carl.* A treatise on chemistry. Vol. I. The non-metallic elements. New edition completely revised by *Sir H. E.* **Roscoe,** assisted by *J. C.* **Cain.** pp. xii + 955. ill. London 1911. (*Reference.*)

Rossitz Experimental Station. Reports on the Austrian coaldust experiments 1908–1909. Abstracted and translated by the *Colliery Guardian* from the *Oesterreichische Zeitschrift für Berg- und Hüttenwesen.* pp. 36. London 1911.

Royal Society of London. Catalogue of a collection of early printed books in the Library. pp. 120. London 1910.

Sadtler, *Samuel S.* See **Allen,** *Alfred Henry.*

Salmon, *William.* Medicina Practica: or, the Practical Physician: Shewing the true method of curing the most usual diseases incident to human bodies. . . To which is added, the chymical works of Hermes

Trismegistus, Kalid King of Persia, Geber King of Arabia, Artefius Longævus the Jew, Roger Bacon, Nicholas Flammel's Hieroglyphicks. George Ripley's Marrow of Alchymie. And an account of their lives. pp. [xxviii] + 696. ill. London 1707. (*Reference.*)

Sarti, *C.* See **Gazzetti,** *C.*

Scheithauer, *W.* Die Schwelteere, ihre Gewinnung und Verarbeitung. pp. viii + 192. Leipzig 1911.

Schidrowitz, *Philip.* Rubber. pp. xv + 303. ill. London 1911.

Schoeller, *Walter.* See **Schrauth,** *Walther.*

Schorlemmer, *Carl.* See **Roscoe,** *The Right Honourable Sir Henry Enfield.*

Schrauth, *Walther,* und **Schoeller,** *Walter.* Über die Desinfektionskraft komplexer organischer Quecksilberverbindungen. I. Aromatischer Quecksilbercarbonsäuren. (From the *Zeitsch. Hyg. Infect.,* 1910, **66.**)

Schroeter, *G.* See **Richter,** *Victor von.*

Scott, *Alexander.* An introduction to chemical theory. 2nd edition. viii + 272. London 1911.

Seeligmann, *Franz,* and **Zieke,** *Emil.* Handbuch der Lack- und Firnis-Industrie. pp. xvi + 953. ill. Berlin 1910.

Seidell, *Atherton.* The solubilities of the pharmacopœial organic acids and their salts. pp. 98. Washington 1910.

Senter, *George.* Outlines of physical chemistry. 2nd edition. pp. xvii + 387. ill. London 1911.

—— Text-book of inorganic chemistry. pp. x + 583. ill. London 1911.

Shaw, *Peter.* See **Boyle,** *Robert.*

Shepherd, *Ernest S.,* and **Rankin,** *George A.* Preliminary report on the ternary system $CaO–Al_2O_3–SiO_2$. A study of the constitution of Portland cement clinker. With optical study by *Fred. E.* **Wright.** (From the *J. Ind. Eng. Chem.,* 1911, **3.**)

Shrivell, *F. W. E.* See **Dyer,** *Bernard.*

Simmons, *William Herbert,* and **Mitchell,** *Charles Ainsworth.* Edible fats and oils. Their composition, manufacture and analysis. pp. viii + 150. London 1911.

Sindall, *Robert Walter.* See **Cross,** *Charles Frederick.*

Sjöström, *Lennart.* See **Hämäläinen,** *Juho.*

Spencer, *James Frederick.* An experimental course of physical chemistry. Part I. Statical experiments. pp. xiv + 228. ill. London 1911.

Stegmüller, *Ph.* See **Beck,** *Karl.*

Stift, *Anton,* and **Gredinger,** *Wilhelm.* Der Zuckerrübenbau und die Fabrikation des Rübenzuckers. pp. viii + 667. ill. Wien 1910.

Stoddart, *Frederick Wallis.* Nitrification and the absorption theory. An account of the principles of the modern sewage filter. pp. 24. Bristol 1911.

Sundwik, *Ernst Edw.* Xanthinstoffe aus Harnsäure. (From the *Skand. Arch. Physiol.*, 1911, **25**.)

Taffanel, *J.* Abstract of the reports of the French coaldust experiments conducted at the Liévin Experimental Station, 1907–10. Abstracted and translated by the "Colliery Guardian." pp. 82. ill. London 1910.

Tesdorpf, *Theodor.* See **Autenrieth,** *Wilhelm.*

Thiel, *A.* Der Stand der Indikatorenfrage. Zugleich ein Beitrag zur chemischen Theorie der Farbe. (Sammlung, Vol. XVI.) Stuttgart 1911.

Thole, *Ferdinand Bernard.* See **Dunstan,** *Albert Ernest.*

Thunberg, *Torsten.* Studien über die Beeinflussung des Gasaustausches des überlebenden Froschmuskels durch verschiedene Stoffe. IV—X. (From the *Skand. Arch. Physiol.*, 1910, **24**, 1911, **25**.)

—— Untersuchungen über autoxydable Substanzen und autoxydable Systeme von physiologischem Interesse. I. and II. (From the *Skand. Archiv. Physiol.*, 1910, **24**.)

Tigerstedt, *Robert.* Zur Kenntnis der Aschebestandteile in der frei gewählten Kost des Menschen. (From the *Skand. Arch. Physiol.*, 1910, **24**.)

Tizard, *Henry Thomas.* See **Nernst,** *Walter.*

Trier, *Georg.* See **Winterstein,** *Ernst.*

Trinum Chymicum oder Drey Chymische Tractätlein. I. Fr. Vincentii Koffsky . . . Schöner und ausführlicher Bericht von der ersten Tinctur-Wurzzel des Steins der Weisen, *etc.* (pp. 1—21 only). Strassburg 1699. (*Reference.*)

Trinum Chymicum secundum oder Drey Andere Chymische Tractätlein. I. Heinrici Khunrath . . . Philosophische Erklärung von und über dem geheimen äusserlichen sichtbaren Gludt und Flammen-Feur der uhralten Magorum oder Weysen und anderer wahren Philosophen. II. Ein fůrtreffliches Judicium und Bericht eines erfahrnen Cabalisten, über die vier Figuren dess grossen Amphitheatri D. Henrici Khunrathi. III. Von der Tinctur Antimonii und Oleo Stibii von Theophrasto Paracelso Auch einem Anhang zu der Materi dienlichen Sachen Von Basilio Valentino beschrieben. pp. [viii] + 174 (misprint for 184). Strasburg 1700. (*Reference.*)

Tutton, *Alfred Edwin Howard.* Crystallography and practical measurement. pp. xiv + 946. ill. London 1911.

Ubbelohde, *L.*, and **Goldschmidt,** *F.* Handbuch der Chemie und

Technologie der Öle und Fette. Vol. III, part 2. pp. xiv + 381 to 1195. ill. Leipzig 1911.

Valentinus, *Basilius*. His last Will and Testament . . . , wherein he . . . declareth the wayes he wrought to obtain the Philosophers Stone, *etc.* London 1657—56. (9 parts, each having separate title-page. Wanting first title-page, and pp. 21 to 23 of a "Treatise concerning Microcosme.") (*Reference.*)

—— The triumphant chariot of antimony, being a conscientious discovery of the many reall transcendent excellencies included in that minerall. Faithfully Englished and published for the common good by J. H. *Oxon.* Printed for Thomas Bruster, and are to be sold at the three Bibles neere the West end of Paules Church-Yard in London, 1660.

A rare first edition not mentioned in the bibliographies and differing from the 1661 edition in date and publisher.

Venturoli, *Giuseppe*, and **Gallerani**, *Guido Tartarini*. Contributo allo studio chimico-tossicologico dell' Adrenalina. (From the *Giorn. Farm. Chim.*, 1911, **60.**)

Wadmore, *John Mello*. Elementary chemical theory. pp. xi + 275. London 1911.

Walter, *Johann*. Einige Notizen über die zwischen aromatischen Amino- und Nitrokörpern auftretenden Färbungen. (From the *Zeitsch. Farb.-Ind.*, 1911.)

Wehmer, *C.* Die Pflanzenstoffe. Chemische Bestandteile und Zusammensetzung der einzelnen Pflanzenarten, Rohstoffe und Produkte. pp. xvi + 937. Jena 1911.

Weimarn, *P. P. von*. Grundzüge der Dispersoidchemie. pp. viii + 127. ill. Dresden 1911.

Werner, *A.* New ideas on inorganic chemistry. Translated by *Edgar Percy* **Hedley**. pp. xvi + 268. London 1911.

Westcott, *W. Wynn*. See **Martindale**, *W. Harrison*.

White, *George F.* See **Bingham**, *Eugene C.*

White, *Harold P.* See **Mingaye**, *John C. H.*

Widmark, *Erik M. P.* Untersuchungen über die chemischen Bedingungen für das Beibehalten der normalen Struktur der Zellen. I. and II. (From the *Skand. Archiv. Physiol.*, 1910, **23, 24.**)

Williams, *Robert S.* See **Ostwald**, *Wilhelm*.

Winterstein, *Ernst*, and **Trier**, *Georg*. Die Alkaloide. pp. vii + 340. Berlin 1910.

Worden, *Edward Chauncey*. Nitrocellulose industry. A compendium of the history, chemistry, manufacture, commercial application and analysis of nitrates, acetates and xanthates of cellulose. . . . With a chapter on guncotton, smokeless powder and explosive cellulose nitrates. 2 vols. pp. xxxiv + 566, xxviii + 567 to 1239. London 1911.

Wright, *Fred E.* See **Shepherd**, *Ernest S.*

Zacharias, *Johannes.* Elektrochemische Umformer [Galvanische Elemente]. pp. xii + 262. ill. Wien 1911.

Zeitschrift für angewandte Chemie. General Register. Jahrgänge 1887 bis 1907. Edited by *Berthold* **Rassow** and *Ernst Wolfgang* **Müller**. pp. iv + 609. Leipzig 1910. (*Reference.*)

Zenneck, *J.* Die Verwertung des Luftstickstoffs mit Hilfe elektrischen Flammenbogens. pp. 29. ill. Leipzig 1911.

Zieke, *Emil.* See **Seeligmann**, *Franz.*

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PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

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Thursday, January 19th, 1911, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. Henry Dent Gardner, jun., and Thomas R. Merton wer formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

John Ewart Trounce Barbary, Vellansaundry, near Camborne.
Harold Christopher, B.Sc., Mona, Lucien Road, Tooting Common, S.W.
Harold Edgar Dryden, 490, Stanton Road, Burton-on-Trent.
James Furnival Eardley, Elmsdale, Broomhall Park, Sheffield.
William Joseph Chetwynd Horne, c/o Messrs. Cleeve Bros., Lansdowne, Limerick.
Reginald Hurst, 50, Culverley Road, Catford, S.E.
James William MacBain, M.A., Ph.D., 71, Cotham Brow, Bristol.
Edward Partington, Oakdene, Sedgley Park, Manchester.
Cyril James Peddle, M.Sc., 146, Barnsley Road, Cudworth, near Barnsley.
David Thomson, M.A., B.Sc., Ph.D., Viewpark, Litham Road, Strathaven, N.B.
William Denham Verschoyle, 15, Winch Building, Vancouver, B.C.
Bertie James Waygood, 39, Marshall Road, Levenshulme, Manchester.

Edward Escott Wood, Hurricane House, Brymbo, N. Wales.
Charles Fursdon Yates, Ronaldene, Witham Road, Isleworth.

Certificates have been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Messrs.:

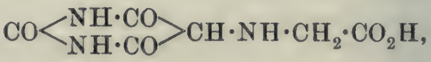
Solomon Farley Acree, Johns Hopkins University, Baltimore, Md., U.S.A.
Robert Leonard Emerson, A.B., M.D., Boston, Mass., U.S.A.

Of the following papers, those marked * were read:

*1. "The interaction of alloxan and glycine."

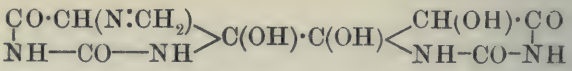
By William Holdsworth Hurtley and William Ord Wootton.

The authors have examined the action of alloxan on glycine in aqueous solution. By mixing concentrated solutions of these, Piloty and Finkh (*Annalen*, 1904, **333**, 22) isolated a substance which they described as glycine purpurate. The authors regard this product as a mixture of at least three substances. They have examined the action as it occurs in dilute solution on heating, and, unlike Strecker (*Annalen*, 1862, **123**, 363) and Piloty and Finkh (*loc. cit.*), find that formaldehyde is evolved. The reaction occurs in several stages, murexide being produced first, then a substance closely related to uramil, and finally a substance isolated by Piloty and Finkh and regarded by them as uramidoacetic acid. This, the main product of the reaction, is a pale yellow, crystalline solid, characterised by powerful reducing properties, by yielding formaldehyde on hydrolysis or by treatment with 50 per cent. nitric acid, by the production of an amide with ammonia, and by the formation of alloxan with dilute nitric acid. The authors are of the opinion that a substance possessing these properties cannot have the formula:

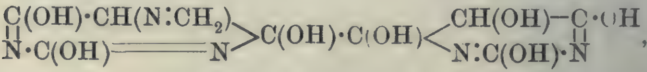


$$\mathrm{CO}\Big<\begin{matrix}\mathrm{NH\cdot CO}\\ \mathrm{NH\cdot CO}\end{matrix}\Big>\mathrm{CH\cdot NH\cdot CH_2\cdot CO_2H},$$

which is assigned to it by Piloty and Finkh; they give it therefore the following constitution, which is more closely in accord with its reactions:



$$\begin{array}{l}\mathrm{CO\cdot CH(N{:}CH_2)}\\ \mathrm{NH{-}CO{-}NH}\end{array}\Big>\mathrm{C(OH)\cdot C(OH)}\Big<\begin{array}{l}\mathrm{CH(OH)\cdot CO}\\ \mathrm{NH{-}CO{-}NH}\end{array}\quad \text{or}$$



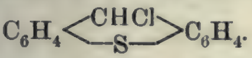
$$\begin{array}{l}\mathrm{C(OH)\cdot CH(N{:}CH_2)}\\ \mathrm{N\cdot C(OH)=\!=\!=N}\end{array}\Big>\mathrm{C(OH)\cdot C(OH)}\Big<\begin{array}{l}\mathrm{CH(OH){-}C\cdot OH}\\ \mathrm{N{:}C(OH)\cdot N}\end{array},$$

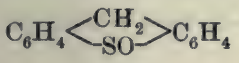
and propose to name it 2 : 4 : 6 : 2′ : 4′ : 5′ : 6′-*heptahydroxy*-5-*methyleneamino*-4 : 5 : 4′ : 5′-*tetrahydro*-4 : 4′-*dipyrimidyl*.

DISCUSSION.

Dr. HURTLEY, in reply to Dr. Pyman, stated that the yield of formaldehyde in this reaction was 7·5 per cent. of the theoretical.

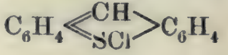
*2. "Intramolecular rearrangements of diphenylmethane *o*-sulphoxide." By Thomas Percy Hilditch and Samuel Smiles.

Diphenylmethane *o*-sulphoxide (I) is obtained by the oxidation of thioxanthen with hydrogen dioxide, and it is converted into the red carbothionium chloride (II) by the action of hydrogen chloride in dry alcohol. This salt is more readily obtained from thioxanthenol with hydrogen chloride in ethereal solution, and, if excess of hydrochloric acid is removed, it is transformed into thioxanthenyl chloride,  $C_6H_4{<}\genfrac{}{}{0pt}{}{CHCl}{S}{>}C_6H_4$. Thioxanthenol is regenerated from the latter substance or from the carbothionium salt by the action of water or alkaline reagents. The transference of oxygen from sulphur to carbon, which may be effected by thus converting the sulphoxide into thioxanthenol, may be carried out by the aid of heat alone, for both substances furnish thioxanthenyl oxide when they are heated to about 120°.



$$C_6H_4{<}\genfrac{}{}{0pt}{}{CH_2}{SO}{>}C_6H_4$$

(I.)



$$C_6H_4{\lessdot}\genfrac{}{}{0pt}{}{CH}{SCl}{>}C_6H_4$$

(II.)

This rearrangement was discussed from a general point of view, and in its bearing on the behaviour of the analogous diphenylamine *o*-sulphoxide.

*3. "The reactions between chemical compounds and living muscle-proteins." By Victor Herbert Veley.

The main conclusions drawn by the author are as follows:

(1) When a living muscle is immersed in solutions of certain compounds, a chemical change takes place between the solute and the amino-acids formed from the muscle-proteins by hydrolysis; its rate can be measured by the height of response to induction shocks used as an indicating record.

(2) In most cases examined, the rate of change is a logarithmic function of time represented by the equation of a reaction of the first order, namely, $K=1/t(\log r_0/r_t)$, in which r_0 is the number of units of potential chemical change, when $t=0$, and r_t the number of units remaining after expiry of time t.

In a few cases the rate of change is a linear function of time, which, although less conclusive, does not exclude the possibility o a chemical change.

If the hypothesis be correct that the chemical changes are du to a reaction between the drug, whether acid or base, and th amino-acid, either formed by hydrolysis of the muscle-proteins o present by virtue of the moribund condition of the muscle, the amino-acids should produce no change, or, in other words, the recor would not differ from that of a fatigue effect. Results were give in the case of aminoacetic acid in proof of this line of argument.

4. "The decomposition of tetramethylammonium nitrite by heat.' By Prafulla Chandra Rây and Hemendra Kumar Sen.

Tetramethylammonium nitrite decomposes at 228—230°, bu more regularly and rapidly at 250—260°. The main gaseou products of decomposition are trimethylamine, methyl nitrite carbon dioxide, nitric oxide, nitrogen, and water. A small fractio of the salt at the same time undergoes charring with the formatio of an oily liquid which soon becomes resinified.

5. "Influence of minute quantities of ferric salts and o manganese nitrate on the rate of solution of mercury i nitric acid." By Prafulla Chandra Rây.

Minute quantities of ferric nitrate (0·026 gram) or ferric sulphat (0·0025 gram) in dilute nitric acid (50 c.c.) containing 12 to 13 pe cent. of the acid have a marked retarding effect on the dissolutio of mercury in it.

Manganese and sodium nitrates, on the other hand, accelerate th dissolution of mercury in nitric acid.

6. "On *dl*- and d-Δ^{2}-m-menthenol(8) and *dl*- and d-$\Delta^{2:8:(9)}$-m-menthadiene." By Walter Norman Haworth, William Henry Perkin, jun., and Otto Wallach.

An account was given of the synthesis of the substances mentioned in the title and of many of their derivatives, by two different methods. The physical properties of all these substances have been determined and were fully discussed.

7. "The identity of xanthaline and papaveraldine." By Bessie Dobson and William Henry Perkin, jun.

The authors have made a careful study of the alkaloid xanthaline, which Messrs. T. and H. Smith (*Pharm. J.*, 1893, p. 793) isolated in very small quantities from opium, and they find that this alkaloid is identical with papaveraldine.

8. "Amalgams containing silver and tin." By Reginald Arthur Joyner.

The non-existence of any compound of silver with tin other than Ag_3Sn is confirmed. The "ageing" of filings of silver-tin alloy has been experimentally verified and investigated. The composition of saturated liquid amalgams of tin, of silver, and of tin with silver has been determined at a number of temperatures, and the equilibrium diagram representing the ternary systems existing below 63° has been ascertained. No ternary compound exists at these temperatures, and the stable solid phases are the compound Ag_3Hg_4 and a solid solution containing a small amount of mercury dissolved in tin. No solid solution exists between these two solid phases. The alloys of silver with tin are thus completely decomposed by the action of excess of mercury. At higher temperatures a ternary compound is formed.

9. "Studies of the constitution of soaps in solution. The electrical conductivity of sodium stearate solutions." By Richard Charles Bowden.

At 90° the equivalent conductivity of sodium stearate in aqueous solution is about half that of sodium acetate, being 88·3 mhos in a weight-normal solution, about 77 for solutions between $N/2$- and $N/20$-, but rising to 125·9 in $N/100$-solution. It is considered that these measurements demonstrate the presence of a high concentration of free electrolyte in solutions of sodium stearate. The change in conductivity with the dilution differs from that in solutions of sodium palmitate, but it is not less remarkable. Attention was drawn to the connexion between these phenomena and the analogous behaviour of certain non-aqueous solutions as well as to the salting out from soap solutions of acid sodium salt by means of concentrated solutions of sodium hydroxide.

10. "Additive compounds of phenols and phenolic ethers with aromatic polynitro-derivatives." By John Joseph Sudborough and Stanley Hoskings Beard.

The authors described a number of additive compounds prepared from *s*-trinitrobenzene and phenols, phenolic ethers, and cyclic oxygen derivatives. Many of the compounds are coloured, but as a rule are much paler than the additive compounds of amines and *s*-trinitrobenzene.

11. "The effect of contiguous unsaturated groups on optical activity. Part VI. The influence of the carbonyl group on optical rotatory power. Part VII. The relative influences of aromatic and hydroaromatic nuclei on optical rotatory power. Part VIII. The influence on optical activity of two contiguous unsaturated groups in comparison with that of one unsaturated group at varying distances from the optically active complex." By Thomas Percy Hilditch.

(1) The author has sought to obtain evidence of the effect of the system $\cdot CO \cdot CO_2H$ on optical rotatory power, in order to effect a comparison with that of the group $\cdot CH\colon CH \cdot CO_2H$, which is now fairly well known.

From investigation of the menthyl esters and brucine salts of ketonic acids of the pyruvic, mesoxalic, and phenylglyoxylic series, it appears that the carbonyl group increases the initial effect of the carboxyl group on the molecular rotatory power of the optically active alcohol or acid, and its influence is thus very similar to that of an ethenoid bond.

(2) The relative influences of aromatic and hydroaromatic nuclei on optical activity have been investigated by means of the salts formed from corresponding aromatic and hydroaromatic bases with optically active acids (camphoric, camphor-π-sulphonic, and tartaric acids). The results show consistently that so long as an aromatic group is contiguous to the basic nitrogen atom, a well-defined optical anomaly persists, but this disappears wherever the radicle attached to the nitrogen is fully reduced. It was also pointed out that "ring-formation," which is usually stated to produce a large alteration in rotatory power, does so only when the asymmetric carbon atoms form part of the ring system.

(3) Rupe (*Annalen*, 1903, **327**, 157) has stated that the nature of the effect of unsaturated groups on optical activity is determined by their nearness to the asymmetric atoms. Experiments have been carried out to decide whether, in certain cases, it is the proximity of an unsaturated system to the asymmetric complex, or the conjugated unsaturated groups present, which causes the anomaly in rotatory power, and it appears that whilst both causes undoubtedly operate, the latter is the more powerful factor.

12. "The relative effects of ethylenic and acetylenic linkings on optical rotatory power." By Thomas Percy Hilditch.

d-*Methylhexylcarbinyl β-phenylpropionate*, *cinnamate*, and *phenylpropionate*, and the neutral and acid *menthyl* esters of *succinic*, *fumaric*, and *acetylenedicarboxylic acids* have been examined with respect to the relative effects of the ethylenic and acetylenic linkings on optical rotatory power; the former series is interesting in view of the simplicity of the asymmetric system in the alcohol used and the similarity of this compound to amyl alcohol.

From a general survey of the fourteen series of active salts or esters of these acids now available for comparison, it is seen that in twelve cases the fully saturated member is least anomalous in optical activity, whilst in the other two the ethylenic and acetylenic compounds respectively possess the smallest rotatory power. On the other hand, it is concluded that there is no general rule to cover the relative effects of the double and triple carbon linkings, and that the influence of the acetylenic (+ carboxyl) residue is in general much less well defined than that of the ethenoid (+ carboxyl) group.

13. "The direct action of radium on ammonia."
By Edgar Philip Perman.

The rate of decomposition of ammonia by the direct action of radium bromide has been measured approximately. The pressure of the ammonia, together with its decomposition products, decreased for five weeks, and then steadily increased. The reaction appears to be of the first order.

14. "Cupritartrates and analogous compounds."
By Spencer Umfreville Pickering.

By adding potassium hydroxide to copper tartrate just short of alkalinity, and precipitating by alcohols, a cupritartrate of the formula $(C_2H_4O_2{\cdot}CuO)_2(CO_2)_4K_2Cu,H_2O$ is obtained, and by the further action of the alkali and water, two others derived from this by the partial substitution of copper for the potassium were also prepared. Analogous compounds of saccharic and mucic acid were obtained, $(C_4H_8O_4{\cdot}CuO)_2(CO_2)_4K_2Cu,H_2O$, as also was an α-cupritartrate, $(C_2H_4O_2{\cdot}CuO)_4(CO_2)_8K_4Cu_2,(CuCO_3)_2,Na_2CO_3$. All six compounds, when dried at a temperature just below that at which they decompose, gave minimum molecular weights agreeing with these formulæ, and inconsistent with the view that the copper displaces the hydrogen in the alcoholic hydroxyl. Probably this hydrogen is displaced by the group $(Cu^{II}OH)^{I}$, the copper in the carboxylic portion of the molecule being present as $(Cu^{IV}O)^{II}$, as in the cupricitrates. Quinic acid forms analogous compounds, but these were not obtained in a pure condition.

15. "Molecular association in water."

By Cyril James Peddle and William Ernest Stephen Turner.

Following on the work of Meldrum and Turner, which revealed the existence of molecular association in water of a number of amides and anilides (*Trans.*, 1908, **93**, 876; 1910, **97**, 1805), it was shown that molecular association in water is of frequent occurrence. A number of carboxylic acids, phenols, and amines have now been examined. Except in the case of the aliphatic amines, most of the substances are distinctly associated. Benzoic acid is more associated in water than in benzene. The appearance of water among the solvents which permit association, so contrary to the general experience and belief in its dissociating power, was explained on the supposition that molecular association in water is really due to a dissociation of complex water molecules, a view suggested in connexion with the amides, and now further developed and applied to other associated solvents.

16. "Note on the preparation of thiobenzanilide."

By Edward de Barry Barnett.

Thiobenzanilide can readily be obtained in 90 per cent. yield by the following modification of Bernthsen's method (*Ber.*, 1878, **11**, 503). Twenty grams of benzanilide are intimately mixed with 10 grams of finely ground phosphorus pentasulphide and 10 grams of finely ground phosphorus trisulphide. The whole is then cautiously heated over a naked flame with continual shaking until fusion takes place. After cooling, the mass is extracted several times with boiling acetone or alcohol, the united extracts rendered strongly alkaline with sodium hydroxide, and then poured into a large bulk of water. The dark solution obtained on filtration is then saturated with carbon dioxide, when the thioanilide is obtained as a yellow, crystalline precipitate, which need not be further purified.

Attempts to apply the above method to the preparation of thioformanilide and thioacetanilide were not successful, owing to the large quantity of tarry matter formed.

17. "Organic derivatives of silicon. Part XIV. The preparation of tertiary silicols." By Frederic Stanley Kipping and John Edward Hackford.

Tertiary silicols, $R_3Si{\cdot}OH$, can be prepared by treating silicones, R_2SiO, with a Grignard reagent; termolecular silicones, $(R_2SiO)_3$, dihydric silicols, $R_2Si(OH)_2$, and substituted metasilicic acids, $R{\cdot}SiO{\cdot}OH$, may also be employed for this purpose.

The following compounds were prepared: *Benzyldiethylsilicol*, $SiEt_2(CH_2Ph)\cdot OH$; *benzylethylpropylsilicol*, $SiEtPr(CH_2Ph)\cdot OH$; *phenylmethylethylsilicol*, $SiMeEtPh\cdot OH$; *phenyldiethylsilicol*, $SiEt_2Ph\cdot OH$; *dibenzylmethylsilicol*, $SiMe(CH_2Ph)_2\cdot OH$; *triphenylsilicol*, $SiPh_3\cdot OH$; *tribenzylsilicol*, $Si(CH_2Ph)_3\cdot OH$. When phenylsilicon trichloride is treated with steam, it gives the anhydride of phenylmetasilicic acid, whereas with water it gives the acid. The anhydride is insoluble in all neutral liquids which were tried, and is probably highly polymerised.

18. "*o*-Carboxyanilides of the sugars."
By James Colquhoun Irvine and Alexander Hynd.

The conditions under which the common reducing sugars condense with anthranilic acid have been ascertained, and it is found that the best results are obtained when solutions of the sugars in dilute alcohol are mixed with excess of the acid and kept in the cold for several weeks. In this way, *galactose-*, *mannose-*, *rhamnose-*, and *maltose-o-carboxyanilides* have been prepared. Lactose gave a negative result. In the case of fructose, the product could not be obtained pure, and the corresponding glucose compound has already been prepared (*Trans.*, 1909, **95**, 1553).

The condensation proceeds by reaction between the amino-group and the reducing group of the sugar, as all the products behave as acids. The compounds appear to be γ-oxides, as they show extremely rapid mutarotation comparable in magnitude and direction with that given by anilides and methylated anilides.

Glucose also condenses with alanine in a similar manner to give *glucosealanide* (m. p. 114°), which, judging from its optical behaviour, exists in *α*- and *β*-forms, which are interconvertible at 90°.

A parallel investigation carried out with tetramethyl glucose shows that reaction does not proceed readily between amino-compounds and the methylated sugar, and even ammonia and hydrogen cyanide are without action in the cold. *Tetramethyl glucose*-p-*phenetidide*, -*β-naphthylamide*, and -p-*toluidide* were, however, prepared. The latter alone is crystalline (m. p. 144°), and shows extensive mutarotation.

19. "The iodobenzenemonosulphonic acids. Part III. 2 : 3-Di-iodo- and 2 : 3 : 4 : 5-tetraiodo-benzenesulphonic acids." By Mary Boyle.

2 : 3-*Di-iodobenzenesulphonic acid* has been prepared by treating *p*-nitroaniline-*o*-sulphonic acid with iodine chloride, the nitro-group

being removed after the displacement of the amino-group by iodine. A new and convenient method of obtaining the initial nitroamino-acid in large quantities has been devised.

The di-iodosulphonic acid separates from mineral acid solutions in shining crystals, and yields crystalline salts and a well-characterised *chloride*; its *methyl* and *ethyl* esters have been prepared. The *tetraiodo-acid* is prepared from *m*-iodoaniline-*p*-sulphonic acid; its *chloride* differs from those containing two or three iodine atoms in possessing a distinct yellow colour.

20. "Occurrence of pentathionic acid in natural waters."

By James Scott Maclaurin.

Pentathionic acid has not previously been found in natural waters. This may be due to the fact that in ordinary analyses of mineral waters no special search is made for such compounds. Some account of the circumstances that led to the discovery of the occurrences of the acid should therefore be of interest.

The water in which it was found was obtained from a lake on White Island. This island, which is the summit of a volcano, lies in the Bay of Plenty about thirty miles from the mainland. The lake covers an area of approximately 15 acres, and has a mean temperature of about 110° (Fahr.). The water is of a very unusual character, containing a great variety of salts and much free hydrochloric acid. In examining it for iodine by the potassium nitrite test, the author noticed the formation of a brown colour, which suggested the presence of a ferrous salt, but, on titrating with potassium permanganate, more permanganate solution was used than the iron (previously determined gravimetrically) could require, even if all were in the ferrous state, and judging by the colour of the water, much of the iron was in the ferric state. There was no organic matter to cause this excessive reduction, and on adding $N/10$-iodine solution no appreciable action took place, showing that the reduction could not be caused by sulphur dioxide or hydrogen sulphide. After removing sulphates by means of excess of barium chloride, and heating the filtrate with bromine water, a further precipitate of barium sulphate was formed, showing that some sulphur compound was present. It seemed probable that this was one or more of the polythionic acids, most probably pentathionic acid. In order to prove the truth or otherwise of this surmise, the water was boiled with mercuric cyanide (Debus, *Trans.*, 1888, **53**, 278). The reaction between mercuric cyanide and pentathionic acid is as follows:

$$Hg(CN)_2 + H_2S_5O_6 = HgS + S_2 + 2SO_3 + 2HCN.$$

If the mercury in the precipitate ($HgS + S_2$) be determined, the equivalent amount of hydrogen in the pentathionic acid can be calculated, and, by precipitating the SO_3 in the filtrate as barium sulphate, the oxygen and part of the sulphur can be estimated. The remainder of the sulphur can be determined in the first precipitate ($HgS + S_2$). The results so obtained approximated roughly to the formula $H_2S_5O_6$. The value for oxygen was, however, too high, and it was thought probable that this was due to the oxidising action of the ferric chloride and hydrogen chloride present in considerable quantities in the water. Attempts to remove these substances by the ordinary methods were unsuccessful, but the difficulties were met by shaking the water with slightly less magnesium oxide than was necessary to neutralise the free acid, and then precipitating the iron with potassium ferrocyanide.

Although the hydrochloric acid could be nearly neutralised by this means, the chlorides so formed reacted with the mercuric cyanide, so that instead of a precipitate of the composition $HgS + S_2$, one containing a large proportion of mercuric chloride was obtained. This rendered the determination of the hydrogen in the pentathionic acid more difficult and less trustworthy than in the absence of mercuric chloride. It was therefore decided to be satisfied with the approximate values for hydrogen already found, but to re-determine the sulphur and oxygen.

For this purpose 2000 c.c. of the water were precipitated in the cold with slightly less barium chloride solution than was necessary to throw down all the SO_3. After twenty-four hours, the barium sulphate was collected, and the filtrate was divided into three portions, *A*, *B*, and *C*. In *A*, the small amount of SO_3 still remaining was estimated by adding excess of barium chloride and keeping for twenty-four hours. This determination was made in the cold, because boiling causes slight decomposition of pentathionic acid. In *B*, the total sulphur was determined by oxidising with bromine water and precipitating with barium chloride. *C* was boiled with mercuric cyanide, the precipitate collected, and the SO_3 in the filtrate determined by boiling with solution of barium chloride. By subtracting the amount of barium sulphate obtained in *A* from the amounts found in *B* and *C* respectively, the sulphur and oxygen of the pentathionic acid were readily calculated., The results so obtained gave $S_5O_{5 \cdot 92}$.

The complete analysis of the water, in percentage composition, is as follows:

SiO_2	0·0080	Mn	0·0014
TiO_2	0·0030	Al	0·3330
SO_3	2·6534	Ca	0·1497
CO_2	0·0130	Mg	0·0790
P_2O_5	nil	K	0·0884
B_2O_3	0·0310	Na	0·2154
As_2O_3	0·00056	Mo	trace
Cl	4·8210	Cu	,,
Br	0·0034	NH_4	0·0091
I	trace	H (in HCl)	0·1328
O (basic)	0·5306	$H_2S_5O_6$	0·0240
Fe	0·1456		9·24236

These results may be re-stated as follows:

NH_4Cl	0·0273	$MnSO_4$	0·0038
KCl	0·1654	$CuSO_4$	trace
NaCl	0·0379	MoO_3	,,
KBr	0·0051	SiO_2	0·0080
KI	trace	TiO_2	0·0030
Na_2SO_4	0·6191	B_2O_3	0·0310
$MgSO_4$	0·3948	As_2O_3	0·00056
$CaSO_4$	0·5090	CO_2	0·0130
$Al_2(SO_4)_3$	2·1090	HCl	4·8338
$Fe_2(SO_4)_3$	0·2600	$H_2S_5O_6$	0·0240
$FeSO_4$	0·1976		9·24236

21. "β-Methyl-$\Delta^{\alpha\lambda}$-dodecadiene and β-methyl-$\Delta_{\alpha\gamma}$-decadiene." By Victor John Harding, Gertrude Maud Walsh, and Charles Weizmann.

An account was given of the preparation of the above-mentioned hydrocarbons from the corresponding tertiary alcohols:

$$CH_2{:}CH{\cdot}[CH_2]_8{\cdot}CMe_2{\cdot}OH \longrightarrow CH_2{:}CH{\cdot}[CH_2]_8{\cdot}CMe{:}CH_2.$$
$$CH_3{\cdot}[CH_2]_5{\cdot}CH{:}CH{\cdot}CMe_2{\cdot}OH \longrightarrow CH_3{\cdot}[CH_2]_5{\cdot}CH{:}CH{\cdot}CMe{:}CH_2.$$

22. "Determination of the vapour pressures of hydrates by a dynamical method." (Preliminary note.) By James Riddick Partington.

The vapour pressures of copper sulphate hydrate ($CuSO_4,5H_2O$) and racemic acid hydrate have been determined by comparing the amounts of water removed from the hydrate and from pure water by a stream of air in a special apparatus.

The values in the first case are higher than the tensimetric (static) values; in the latter case, the vapour pressures exhibit a maximum with respect to extent of dehydration as independent variable. Both phenomena are found to be mathematical consequences of the initial formation of an unstable lower hydrate, or unstable anhydrous substance, which passes slowly into a stable form.

23. "A simple demonstration of Gibbs's phase rule."
By James Riddick Partington.

The proof of the phase rule given by Gibbs (*Scientific Papers*, vol. 1, pp. 62—100) is far too difficult to present to beginners in physical chemistry, and the following much simplified exposition of Gibbs's original demonstration has been found quite intelligible to students, and may be useful to teachers.

The assumption is made that it is possible to have a state of equilibrium between several phases at a definite temperature and pressure; this will be characterised by certain definite relations between the compositions of the phases (for example, a solid salt, saturated solution, vapour of the solvent).

Let p, θ = total pressure and temperature of the system.
n = number of components.
r = ,, ,, phases.

For each pair of phases there must be some condition satisfied for each component, such that this particular component does not pass from one phase to the other. The r-phases may now be arranged in $(r-1)$ pairs, namely, (1, 2), (2, 3), (3, 4), . . $\{(r-1), r\}$, and there will therefore be $(r-1)$ conditions to be satisfied for each component in all the phases, that is, $(r-1)$ equations defining the equilibrium. It is evident that such pairs as (1, 3), (2, 4), etc., need not be considered, since, if phase (1) is in equilibrium with phase (2), and phase (2) with phase (3), then (1) will also be in equilibrium with (3). If this were not the case, we could, by enclosing (1), (2), (3) in a ring-shaped tube, so that there are three surfaces of separation, set up a continuous circulation at a uniform temperature, which is contrary to the second law of thermodynamics.

For all the components there will therefore be $n(r-1)$ equations.

The number of variables is made up of:

(i) the pressure p,

(ii) the temperature θ,

(iii) the number of concentrations $= r(n-1)$, since for each phase we have $(n-1)$ fractions of the total mass for the n components, the last (nth) fraction, being obtained by subtracting the sum of all the others from the total mass, is fixed, and is not an independent variable, therefore:

$$\text{number of variables} = 2 + r(n-1).$$

The number of variables left undetermined

$$\begin{aligned} &= \text{number of variables} - \text{number of equations} \\ &= 2 + r(n-1) - n(r-1) \\ &= 2 + n - r. \end{aligned}$$

This, however, is defined as the number of degrees of freedom (F) of the system, hence:

$$F + r = n + 2 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (a).$$

If any component is absent from a particular phase (for example, the vapour phase, or a solid phase), there is one variable less, but also one boundary condition less, for migration of that component cannot occur with respect to the phase considered. The equation (a) is therefore still true.

24. "Cholesterol and fatty acids."

By James Riddick Partington.

The solids separating from a fused mixture of cholesterol with palmitic, stearic, or oleic acid are found, by an examination of the freezing-point curves, to be either pure substances, or mechanical mixtures of these substances, and not compounds, as has been previously assumed.

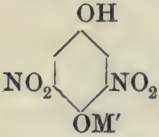
25. "Salts of the dinitrodihydroxybenzenes."

By William Bayliss Shaw.

Although the dinitrodihydroxybenzenes have been known for some years, no systematic investigation of their salts has been carried out.

The author has prepared a complete series of the alkali-metal salts of 3 : 5-dinitroquinol, 3 : 5-dinitrocatechol, and 4 : 6-dinitroresorcinol by the addition of an alcoholic solution of the metallic hydroxide to the nitro-compound dissolved in an indifferent solvent, such as ether.

In the case of the quinol and catechol derivatives, two series of salts have been prepared, having the formulæ:



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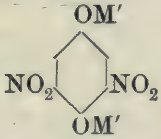

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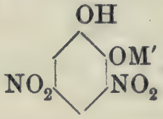

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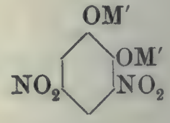

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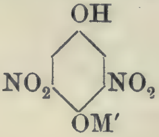
Only the neutral salts of dinitroresorcinol have been obtained.

A sharp colour distinction exists in the quinol and catechol series between the neutral and acid salts.

The acid salts of the forms



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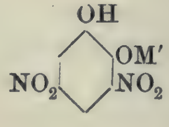
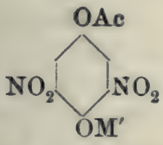
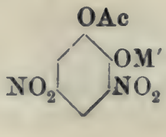


are all of an orange or red tint, whilst the neutral salts are almost black.

The neutral salts of dinitroresorcinol resemble the acid salts of the other two series, no darkly coloured substances having been found.

It has also been possible to prepare, although not in a high degree of purity, salts of the formulæ:





by employing the dinitro-diacetate in place of the free nitro-compound, since one of the acetyl groups is much more easily removed than the other.

By acting on a neutral salt with methyl sulphate, the corresponding monomethyl ether can be obtained. The introduction of two methyl groups by this means has not been accomplished.

All attempts to methylate 4:6-dinitroresorcinol with methyl sulphate have failed.

Some fifty new salts have been prepared, and it is hoped to publish full details shortly.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Bothamley, *Charles Herbert.* The Ilford manual of photography. pp. vi + 218. ill. Ilford. n.d. (*Recd.* 7/1/11.)

From Messrs. Ilford, Ltd.

Dyer, *Bernard*, and **Shrivell**, *F. W. E.* The manuring of market garden crops. pp. 144. ill. London 1910. (*Recd.* 16/1/11.)

From the Authors.

Martindale, *W. Harrison*, and **Westcott**, *W. Wynn.* "Salvarsan" or "606" (Dioxy-diamino-arsenobenzol). Its chemistry, pharmacy, and therapeutics. pp. xv + 77. London 1911. (*Recd.* 3/1/11.)

From the Publishers: Messrs. H. K. Lewis.

Scott, *Alexander.* An introduction to chemical theory. 2nd edition. viii + 272. London 1911. (*Recd.* 11/1/11.) From the Author.

II. *By Purchase.*

Fischer, *Ferdinand.* Kraftgas, seine Herstellung und Beurteilung. pp. viii + 236. ill. Leipzig 1911. (*Recd.* 18/1/11.)

Gildemeister, *Eduard,* and **Hoffmann,** *Friedrich.* Die ätherischen Öle. 2nd edition. Vol. I. pp. viii + 697. Leipzig 1910. (*Recd.* 15/12/10.)

Neubauer, *Carl Theodor Ludwig,* and **Huppert,** *Karl Hugo.* Analyse des Harns. 11th edition. 1st half. pp. xiv + 682. ill. Wiesbaden 1910. (*Recd.* 18/1/11.)

Salmon, *William.* Medicina Practica : or, the Practical Physician: Shewing the true method of curing the most usual diseases incident to human bodies. . . To which is added, the chymical works of Hermes Trismegistus, Kalid King of Persia, Geber King of Arabia, Artefius Longævus the Jew, Roger Bacon, Nicholas Flammel's Hieroglyphicks. George Ripley's Marrow of Alchymie. And an account of their lives. pp. [xxviii] + 696. ill. London 1707. (*Reference.*)

Stift, *Anton,* and **Gredinger,** *Wilhelm.* Der Zuckerrübenbau und die Fabrikation des Rübenzuckers. pp. viii + 667. ill. Wien 1910. (*Recd.* 18/1/10.)

At the next Ordinary Scientific Meeting on **Thursday,** February **2nd,** 1911, at **8.30** p.m., the following papers will be communicated:

"The constancy of water of crystallisation in hydrated salts. Part I." By H. B. Baker and G. H. J. Adlam.

"Different methods of applying the Grignard reagent." By H. Davies and F. S. Kipping.

"The orientation of the nitro-group in nitromyristicinic acid." By A. H. Salway.

"The condensation of aromatic aldehydes with nitromethane." By F. G. P. Remfry.

"The phosphoric acids." By A. Holt and J. E. Myers.

"The determination of solubility coefficients by aspiration." By W. J. Jones.

"The triazo-group. Part XVI. Interaction of nitrosates and sodium azide." By M. O. Forster and F. M. van Gelderen.

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Issued 10/2/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 381.

Thursday, February 2nd, 1911, at 8.30 p.m., Professor Harold . Dixon, M.A., Ph.D., F.R.S., President, in the Chair.

Certificates were read for the first time in favour of Messrs.:

John Eric Collington, Claremont, Noel Road, Edgbaston.
Clement Arthur Crook, 4, Dry Clough Lane, Halifax.
William Henry Dickinson, Capt. (I.M.S.), M.B., Ch.B., Grant Medical College, Bombay.
Ralph Roscoe Enfield, B.A., Toynbee Hall, Commercial Street, E.
Oswald Mansell-Moullin, B.A., 69, Wimpole Street, W.
George Arncliffe Percival, 34, Cartwright Gardens, W.C.
Albert Cherbury David Rivett, B.A., B.Sc., Chemistry Dept., University, Melbourne.
William Arthur Reginald Wilks, M.A., 50, Stowheath Lane, Priestfield, Wolverhampton.

Of the following papers, those marked * were read:

26. "The constancy of water of crystallisation in hydrated salts. Part I." By Herbert Brereton Baker and George Henry Joseph Adlam.

The authors have found that telluric acid always contains an cess of water over the calculated amount even when dried by hosphoric oxide for six months in a vacuum. This excess is due to water occluded in the crystals, and water vapour cannot pass through a thin crystal of this substance. Determinations of the atomic weight of tellurium have been made by estimating the weight of water given off in the decomposition of telluric acid, as well as the total loss of weight. The mean of four determinations of the ratio $TeO_2 : O$ gave an atomic weight of 127·49. Experiments have been made with other hydrated crystals to find if such substances can be obtained in such a state as to be available for atomic weight determinations. By keeping the salts in an atmosphere containing a quantity of the partly dehydrated salt, such salts can be completely freed from adherent moisture. One such experiment with crystallised barium chloride ($BaCl_2,2H_2O$) gave 14·772 per cent. of water instead of 14·747. The similar method used by Guye and Tsakalotos (*J. Chim. phys.*, 1909, **8**, 3) gave with the same salt 14·6765 per cent. of water. It was shown that if a salt be completely dehydrated and left in a moist atmosphere, it will take up almost exactly the amount of water which corresponds with its water of crystallisation. For barium chloride the percentage was 14·750 instead of 14·747.

Further, it has been shown that air will not pass through a crystal when the latter is used to close a vacuum tube. Water vapour will, however, pass through hydrated crystals from a moist atmosphere to a dehydrating agent, but a partial dehydration of the crystal on the side nearest to the dehydrating agent seems to be necessary. Water vapour will not pass through anhydrous crystals, and therefore occluded water cannot be removed by placing in a desiccating atmosphere.

DISCUSSION.

The PRESIDENT asked whether it was possible to obtain anhydrous telluric acid, H_2TeO_4, and whether the ortho-acid, H_6TeO_6, could be made by allowing the more or less anhydrous acid to take up moisture from an unsaturated atmosphere.

Dr. SENTER said that if he understood the author rightly it was claimed that drying a salt hydrate over a mixture of the same hydrate and the anhydrous salt would remove all the moisture from the surface of the hydrate crystals. The method in question would ensure against dehydration being carried too far, but it appeared open to doubt whether it could be relied on to effect the complete removal of adsorbed moisture in all cases when one remembered the remarkable tenacity with which such moisture was sometimes held. The data given by the authors showed that the method was effective for barium chloride, but other salt hydrates in crystalline form might conceivably have much greater power of retaining adsorbed oisture. He wished to ask Dr. Baker if further data were available on this point.

Dr. R. LESSING asked if the size of crystals had any influence on he amount of "adherent" or "occluded" water, and whether it as possible to facilitate the removal of this water by finely grinding he crystals.

In reply to the President, Dr. BAKER said that anhydrous telluric cid took up water with extreme slowness. It was insoluble in ater, and it did not become completely hydrated by remaining in ater for three months. In answer to Dr. Senter, it was stated hat the experiments now in progress would decide whether the ethod was a general one.

27. "The triazo-group." Part XVI. Interaction of nitrosates and sodium azide." By Martin Onslow Forster and Frederik Marinus van Gelderen.

The azoimide nucleus may be substituted for the nitroxyl group n nitrosates and ethereal nitrates.

β-Triazo-β-methylbutan-γ-oxime, $N_3{\cdot}CMe_2{\cdot}CMe{:}NOH$, prepared rom *iso*amylene nitrosate and sodium azide, melts at 34—35°; it s freely soluble in organic media, and is volatile in steam. *β-Triazo-*-*methylbutan-γ-one*, $N_3{\cdot}CMe_2{\cdot}CO{\cdot}CH_3$, produced on hydrolysing he oxime with dilute mineral acids, boils at 42°/14 mm., and as D 1·0057/18°. The *semicarbazone*, $C_6H_{12}ON_6$, and *thiosemi-arbazone*, $C_6H_{12}SN_6$, melt at 127° and 106—107° respectively.

The triazo-ketone leads to the amino-ketone on reduction, but his is stable only in the form of salts; alkalis convert these into examethyldihydropyrazine, which has been lately described by abriel (*Ber.*, 1911, **44**, 57).

28. "The triazo-group. Part XVII. Nitroso-azides of pinene and terpineol." By Martin Onslow Forster and Sidney Herbert Newman.

Nitroso-azides may be prepared by interaction of nitroso-hlorides and sodium azide. *Pinene nitrosoazide*, $C_{10}H_{15}({:}NOH){\cdot}N_3$, rystallises in brilliant, transparent prisms, melting at 120°; it is nimolecular, and the *acetyl* derivative melts at 64°. Alcoholic iperidine or sodium ethoxide gives rise to nitrosopinene. An *omeride* of pinene nitrosoazide arises when the original material heated with water, and melts at 126°, the *acetyl* derivative elting at 71°; it also yields nitrosopinene with alcoholic sodium thoxide, but the continued action of hot water leads to the oxime of hydroxydihydrocarvone, melting at 133·5°. The last-named substance is produced also by the action of alcoholic sodium ethoxide on *terpineol nitrosoazide*, $OH\cdot C_{10}H_{16}(\dot{:}NOH)\cdot N_3$, which is prepared from terpineol nitrosochloride and sodium azide, and melts a 111°.

*29. "The synthesis of 3-β-aminoethylindole."

By Arthur James Ewins.

The condensation of γ-aminobutyrylacetal and phenylhydrazine, by heating with zinc chloride to 180°, yields 3-β-*aminoethylindole* (m. p. 146°), the amine derived from tryptophan by loss of carbon dioxide. Its most characteristic salt is the *picrate*, red needles, m. p. 242—243°.

The *hydrochloride*, *picrolonate*, and *benzoyl* derivative were also described. The base is physiologically active.

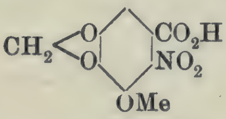
DISCUSSION.

In reply to Dr. Pyman, Mr. EWINS stated that the yield of 3-β-aminoethylindole was from 40 to 50 per cent. of the theoretical.

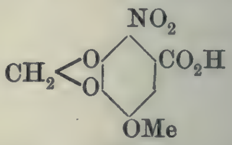
30. "The orientation of the nitro-group in nitromyristicinic acid."

By Arthur Henry Salway.

In a previous investigation (*Trans.*, 1909, **95**, 1155) the author had occasion to prepare nitromyristicinic acid, the constitution of which could be represented by one of the two following formulæ:



(I.)



(II.)

It has now been shown that this acid may be converted into cotarnic acid by the transformation of the nitro-group into a carboxylic group. The constitution of nitromyristicinic acid must therefore be represented by formula (I).

31 "The condensation of aromatic aldehydes with nitromethane."

By Frederic George Percy Remfry.

The facility with which aromatic aldehydes condense with nitromethane in the presence of alcoholic potash is affected by the nature and position, with regard to the aldehyde radicle, of any substituting groups in the benzene ring. An attempt was made to ascertain the conditions which govern the condensation, and for this purpose a number of aldehydes, with different substituents variously placed in the ring, were condensed with nitromethane. The results obtained, however, did not permit of any generalisation being put forward, owing to the fact that anomalies were observed in some cases which at present have not been satisfactorily explained.

The following compounds were described: ω-*Nitro*-o-, -m-, and -p-*hydroxystyrene*, $OH\cdot C_6H_4\cdot CH{:}CH\cdot NO_2$ (m. p. 133—134°, 132—133°, and 165° respectively); *ω-nitro*-p-*acetoxystyrene* (m. p. 158—159); *ω-nitro*-p-*benzoyloxystyrene* (m. p. 156°); *ethyl ω-nitrostyryl*-p-*oxyacetate*, $NO_2\cdot CH{:}CH\cdot C_6H_4\cdot O\cdot CH_2\cdot CO_2Et$ (m. p. 82°); *ethyl ω-nitrostyryl*-m-*oxyacetate* (m. p. 147—148°); p-*chloro-ω-nitrostyrene* (m. p. 111—112°); ω-3-*dinitro-2-hydroxystyrene* (m. p. 174—175°); ω-3-*dinitro-4-methoxystyrene* (m. p. 165—166°); *β*-3: 5-*trinitro-4-methoxy-α-phenylethanol*,

$$OMe\cdot C_6H_2(NO_2)_2\cdot CH(OH)\cdot CH_2\cdot NO_2;$$

β-nitro-2: 5-*dihydroxyphenylethanol* (m. p. 182°); *ethyl 3-aldehydosalicylate*, $CHO\cdot C_6H_3(OH)\cdot CO_2Et$ (m. p. 66—67°); *ethyl 5-aldehydosalicylate* (m. p. 69°), and its 3-*nitro*-derivative (m. p. 79—80°); *ω-nitro-2-hydroxy-3-carboxystyrene* (m. p. 231°); 3-*nitro-5-aldehydosalicylic acid* (m. p. 177°); 5-*nitro-3-aldehydosalicylic acid* (m. p. 195—196°), and 1-*ω-nitrovinyl-β-naphthol* (m. p. 187—188°).

32. "The phosphoric acids."
By Alfred Holt and James Eckersley Myers.

The experiments carried out by the authors lead to the following conclusions:

(1) Pyrophosphoric acid is formed as an intermediate compound during the hydration of metaphosphoric acid.

(2) The rate of hydration does not accord with any simple order of reaction.

(3) Meta- and pyro-phosphoric acids, when prepared by dehydrating the ortho-acid, give complex molecules in solution, but when prepared by decomposing the corresponding lead salts, simpler molecules result.

33. "The determination of solubility coefficients by aspiration."
By William Jacob Jones.

If a volume V c.c. of air be bubbled through a volume v c.c. of a well-stirred solution containing initially a grams of gaseous solute, and if the air in its passage through the solution abstract and carry along with it c grams of solute, then the solubility coefficient s of that gas in the liquid is given by the expression:

$$s = \frac{V}{v.\log_e \frac{a}{(a-c)}}.$$

A form of apparatus has been devised whereby an accurate knowledge of the quantities V, v, a, and c, and consequently of s, is rendered possible.

34. "α-Amino-α-phenylacetamide and some of its derivatives." By Charles Hugh Clarke and Francis Francis.

α-Amino-α-phenylacetamide, $C_6H_5{\cdot}CH(NH_2){\cdot}CO{\cdot}NH_2$, is easily obtained, in the form of its *benzylidene* derivative, by the action of potassium hydroxide solution and ammonia on benzaldehyde-cyanohydrin in the presence of benzaldehyde. From this condensation product the free base itself is isolated by the action of phenylhydrazine with subsequent separation, based on the solubility of α-amino-α-phenylacetamide in water.

α-Amino-α-phenylacetamide is a strong base, and easily condenses with aldehydes. Its *carbethoxy*-derivative lends itself so readily to the formation of hydantoin that this constitutes the best method for the formation of substances of this class. On the other hand, no derivatives of the base could be prepared from which it was possible to isolate six-membered cyclic substances.

35. "Methylammonium nitrite." By Prafulla Chandra Rây and Jitendra Nath Rakshit.

Methylammonium nitrite, $CH_3{\cdot}NH_3{\cdot}NO_2$, is formed in the interaction of mercuric nitrite and methylamine, and it is readily prepared by triturating methylamine hydrochloride with silver nitrite in the presence of a little water. On evaporating in a vacuum the filtrate after removal of silver chloride, lustrous crystals are obtained.

Methylammonium nitrate has a pale greenish-yellow colour, and is extremely deliquescent. It decomposes when kept in a desiccator, and, when heated, methyl alcohol and nitrogen are produced together with some secondary products of decomposition.

36. "The picraminobenzoic acids and their salts." By James Codrington Crocker and Frank Matthews.

The three picraminobenzoic acids and the salts derived from them were described. The ordinary salts are generally of the "acid" type, containing two equivalents of the acid radicle to one of the base. The "semi" or acid salts have the general formula $CO_2M{\cdot}C_6H_4{\cdot}NHR,CO_2H{\cdot}C_6H_4{\cdot}NHR$ (where R denotes the picramyl group). This type of salt is only moderately soluble in water, and in most cases is completely hydrolysed even in the cold by excess of water, with precipitation of the acid, alkali remaining in solution. The "normal" salts are easily soluble in water, and show little hydrolysis in solution. The following substances were prepared:

o-*Picraminobenzoic acid* (m. p. 270°) and the acid o-*picraminobenzoates* of sodium, potassium, ammonium, methylamine, ethylamine, aniline, and pyridine; also the normal *silver* salt of *o*-picraminobenzoic acid.

m-*Picraminobenzoic acid* (m. p. 234°) and the acid m-*picraminobenzoates* of sodium, potassium, methylamine (two salts), ethylamine, and guanidine; also the normal *potassium* salt of *m*-picraminobenzoic acid.

p-*Picraminobenzoic acid* (m. p. 285°) and the acid p-*picraminobenzoates* of potassium and methylamine, and the normal salts of sodium and ammonium.

Quantitative experiments on the hydrolysis by water of the acid potassium salt of the *o*-acid were also carried out. It was shown that when the salt was in excess, equilibrium was attained when a certain constant concentration of alkali in solution was reached (about $N/250$ at 25°).

37. "New derivatives of *d*-glucosamine."

By James Colquhoun Irvine, David McNicoll, and Alexander Hynd.

Glucosamine hydrochloride reacts with acetyl bromide to give *bromotriacetylglucosamine hydrobromide* (m. p. 149—150°, $[\alpha]_D + 148{\cdot}4°$), which serves as the starting point in the preparation of a number of glucosamine derivatives. The compound exists in α- and β-forms, shows normal mutarotation when dissolved in anhydrous acetone, and condenses readily with hydroxy-compounds. When acted on by traces of water, it is completely converted into glucosamine hydrobromide, owing to hydrolysis and the slow removal of the acetyl groups. By condensation with methyl alcohol, in the presence of pyridine, it gives *triacetylmethylglucosamine hydrobromide* (m. p. 230—233°), which has $[\alpha]_D + 20{\cdot}2°$ in methyl-alcoholic solution, and behaves as a β-glucoside. The acetyl groups may be eliminated from this compound by boiling with barium hydroxide, or by the action of dilute alcoholic hydrogen bromide in the cold, the reaction giving *methylglucosamine* as a strongly alkaline glucosidic syrup.

The *hydrochloride* of the latter appears to be a mixture of α- and β-stereoisomeric forms (m. p. 185—187°, $[\alpha]_D$ in water $-19{\cdot}5°$); the compound closely resembles the aminomethylglucoside hydrochloride recently obtained by Fischer (*Ber.*, 1911, **44**, 132), and is possibly identical with it. The substance is, however, remarkably stable towards hydrolytic agents, but is converted into glucosamine hydrochloride by the action of concentrated hydrochloric acid. By similar treatment, all the compounds described give glucosamine salts, and are thus true derivatives of glucosamine. The conclusion is also drawn that the use of pyridine and silver salts in the preparation of the compounds has no effect on the configuration or on the amino-group.

The work is being continued with the object of correlating glucosamine with glucose and of preparing sugar complexes containing the glucosamine residue.

38. "The interaction of silver nitrate and potassium persulphate and its catalytic effect in the oxidation of organic substances." By Percy Corlett Austin.

A detailed analysis of the black precipitate which results from the interaction of aqueous solutions of silver nitrate and potassium persulphate was found to verify the assumption made by Marshall (*Proc. Roy. Soc. Edin.*, 1900, **23**, 163) that the silver persulphate, first formed, is partly decomposed by water according to the equation $Ag_2S_2O_8 + 2H_2O = Ag_2O_2 + 2H_2SO_4$. The precipitate appears to be a mixture of silver dioxide, silver persulphate, and a small percentage of water in proportions which vary slightly according to the conditions of the experiment. The catalytic effect of adding a trace of silver nitrate in the oxidation of various organic substances by means of aqueous potassium persulphate was studied. Whereas, in the absence of silver nitrate, oxidation did not appear to take place, the presence of a trace of this catalyst produced a very marked effect with toluene, when benzaldehyde and benzoic acid were quickly formed. Under similar conditions, thymol gave dithymol.

39. "The isomerism of ferrocyanides."
By Samuel Henry Clifford Briggs.

The author finds that ferrocyanides exist in two forms, which are related to each other in the same way as are the α- and β-ferricyanides of Locke and Edwards (*Amer. Chem. J.*, 1899, **21**, 193, 413), and which have therefore been termed α- and β-ferrocyanides. The α-ferrocyanides of the alkali metals are lemon-yellow in colour, and the β-ferrocyanides are orange- or amber-coloured. The difference in colour persists in solution, and when one form is converted into the other in solution, a corresponding change in colour is observed.

Acids convert the α-ferrocyanides into β-ferrocyanides; cyanides, ammonia, and alkalis effect the opposite transformation.

Nine ferrocyanides have been obtained in the two modifications. The α- and β-ferrocyanides of *l*-menthylammonium have $[\alpha]_D^{17}$ −42° and −28° respectively in absolute alcoholic solution. The conversion of the α-ferrocyanide into the β-ferrocyanide is accompanied by a corresponding fall in specific rotation.

The α- and β-ferrocyanides are related to each other in the same way as the green and yellow platinocyanides of Levy (*Trans.*, 1908, **93**, 1446).

Reasons were adduced to show that the α- and β-ferrocyanides are stereoisomeric in accordance with the author's theory of complex salts (*Trans.*, 1908, **93**, 1564).

At the next Ordinary Scientific Meeting on **Thursday**, **February 16th, 1911**, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Different methods of applying the Grignard reagents." By H. Davies and F. S. Kipping.

"The formation and reactions of imino-compounds. Part XV. The production of imino-derivatives of piperidine leading to the formation of the ββ-*dl*-substituted glutaric acids." By F. B. Thole and J. F. Thorpe.

"The interaction of copper and nitric acid in presence of metallic nitrates. Part II." By E. H. Rennie and W. T. Cooke.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, February 16th, 1911.

Ashe, Albert, F.R.M.S.,

Laurie Square, Romford, Essex.

Technical Microscopist and Chemist. For thirty years Chief Assistant to Mr. John Hughes, F.C.S., F.I.C., Mark Lane, E.C.

John Hughes. W. C. Young.
Bernard Dyer. Fredk. J. Lloyd.
Arthur R. Ling. John Ruffle.
B. F. R. Newlands.

Allan, James, M.A., B.Sc. (Lond.),

Ravenscourt, Lerwick, Shetland Isles.

Science Master, Anderson Educational Institute, Lerwick. Ten years Teacher of Science, including Chemistry. Pupil of Dr. J. Mackenzie and Dr. A. McKenzie, Birkbeck College, and of Drs. H. and W. Fresenius, Wiesbaden. Analyst of rocks and soils, Shetland Field Club.

Alex. McKenzie. Henry Wren.
G. W. Clough. *G. H. Martin.*
G. D. Lander.

Anderson, Edward,

Hill View House, Waun Wen Road, Swansea.

Metallurgical and Analytical Chemist to Messrs. William Foster & Co., Morfa Copper Works, Swansea. Twelve years Senior Assistant, and three years Chief Chemist, to above Company, who have Copper Works, Spilter Works, and Cobalt Works.

W. R. E. Hodgkinson. *Oliver Trigger.*
E. A. Tyler. *Robert Robertson.*
John W. Towers. *A. Vincent Elsden.*
A. H. Coote.

Barbary, John Ewart Trounce,
Vellansaundry, near Camborne.

Technical and Explosive Chemist. Five years Camborne School of Mines (Student). Five years Chemist in Charge, Safety Fuse Works, Roskear, Camborne, Cornwall.

J. J. Beringer. William Bate.
H. W. Hutchin. Andrew L. Scott.
Wm. T. Thomson.

Bate, Joseph,
59, Southwood Lane, Highgate, N.

Schoolmaster and Instructor of Chemistry. First Class Inter. B.Sc. (Lond.). Reading for final B.Sc. Teacher of Chemistry ten years, including five years as Instructor in Charge of Laboratory at Acland School, Kentish Town, N.W., 1905–10. Desirous of keeping in touch with modern developments of Chemistry.

Wm. W. Underhill. W. H. Mills.
William Waters Butler. Frank E. Weston.
A. E. H. Tutton.

Blackburn, Joseph Mayson,
346, Deane Church Lane, Bolton.

Analytical and Consulting Chemist and Perfumer of Watts Bros., 43, High Street, Manchester. First Class, Stage III., Organic and Inorganic Chemistry, South Kensington. Formerly Proprietor of Joseph Blackburn and Co., Chemical and Ammonia Manufacturers, 109, Baldwin Street, Bolton, and also former Demonstrator, Municipal Secondary School, Bolton.

Charles A. Fogg. Frank Smith.
Ernest Boardman. *T. M. Nightingale.*
Charles Smith. *J. L. Whiteside.*

Burbridge, Walter Norman,
"Uplands," Foxley Lane, Purley, Surrey.

Analytical Chemist. Certificated Student, Finsbury Technical

College. Late Assistant to Mr. A. Chaston Chapman, F.I.C. Chemist to the London General Omnibus Co., Ltd.

Alf. Chaston Chapman. H. Droop Richmond.
R. Meldola. H. Wilson Hake.
Fred. T. Harry.

Carmichael, John Fisher,

Tower Building, Liverpool.

Chemical Engineer. | B.Sc. (Vict.). Specialist in the technology of evaporation and distillation in Vacuo: Patent 26619, '07.

A. W. Titherley. J. S. Smythe.
J. F. Haws. *W. Collingwood Williams.*
Prosper H. Marsden.

Christopher, Harold,

"Mona," Lucien Rd., Tooting Common, S.W.

Research Student at University College, London. B.Sc. of London University, Second Class Honours in Chemistry. Conducted researches in organic chemistry for Dr. Smiles.

William Ramsay. J. Norman Collie.
Samuel Smiles. T. P. Hilditch.
P. May.

Cutner, Morris,

21, Bairstow Street, Preston, Lancs.

Science Master, The Grammar School, Preston. Student at King's College, London, 1906–09. Daniell Research Scholarship, King's College, London. B.Sc. (Lond.); Honours in Chemistry. I am desirous of keeping in touch with the latest advances in the science.

John M. Thomson. Herbert Jackson.
Patrick H. Kirkaldy. Charles A. Keane.
H. Burrows.

Devlin, James Edward A.,

Marist Brothers College, and Hazeldene, Baird Street, Uitenhage, Cape Colony.

Teacher (Science). Lecturer in Chemistry to Intermediate and B.A. degree students. Certificated teacher (England). Science master Marist Bros. College, Uitenhage, Cape Colony.

P. T. O'Sullivan. Patrick J. D. Fielding.
Daniel J. O'Mahony. *Thos. Farrington.*
W. B. Harrington.

Dryden, Harold Edgar,

490, Stanton Road, Burton-on-Trent.

Analytical Chemist. Analytical Chemist at S. Allsopp & Sons, Ltd., Brewers, Burton-on-Trent. Ten years Assistant to Lawrence Briant, Esq., Public Analyst, 24, Holborn Viaduct. Student at City and Guilds' Technical College, Finsbury. Also of University Corr. College, Cambridge, etc.

Lawrence Briant. R. Meldola.
Harold Harman. F. Henry Streatfeild.
Léon E. Walling.

Eardley, James Furnival,

"Elmsdale," Broomhall Park, Sheffield.

Pharmaceutical Chemist. Minor and Major Qualifications of the Pharmaceutical Society, 1877.

Arthur W. Crossley. John Evans.
G. E. Scott-Smith. G. T. W. Newsholme.
J. Rymer Young.

Fielding, Michael Angelo,

8, St. Joseph's Place, Cork.

Chemist. Member of Pharmaceutical Society of Great Britain.

Patrick J. D. Fielding. Daniel J. O'Mahony.
P. T. O'Sullivan. *Thos. Farrington.*
A. E. Dixon.

Gardner, William Temple,

Bruern, Alexandra Road, Upper Parkstone, Dorset.

Chemist to Bournemouth Gas and Water Co. Member of the Pharmaceutical Society of Great Britain. At present, and during the past seven years, Works Chemist to the Bournemouth Gas and Water Company.

Harold G. Colman. Philip G. G. Moon.
Hubert Painter. *Fred. Hudson-Cox.*
George Brownen.

Griffiths, Evan Dalton, B.Sc.,

9, Wanstead Park Avenue, Manor Park, E.

Science Master (Chemistry and Physics), East Ham Technical College. Three years at University College of Wales, Aberystwyth, where I studied Chemistry under Dr. Lloyd Snape and Dr. Sudborough. B.Sc. degree, including Inorganic and Organic final course, 1901. Nine years' experience as Chemistry Master and Lecturer.

W. H. Barker. A. E. Dunstan.
W. T. Clough. T. P. Hilditch.
R. W. Wilson.

Hall, Arthur Bennett,
31, Dyer Street, Kirkham, Lancs.

Pharmaceutical Chemist. Minor and Major certificates of the Pharmaceutical Society.

Arthur W. Crossley. David J. Williams.
Chas. Horne Warner. Chas. Turner.
Charles Gilling.

Hampshire, Charles Herbert,
19, Brook Street, Ilkley, Yorks.

Demonstrator in Chemistry in the Pharmaceutical Society's School. Pharmaceutical Chemist. B.Sc. (Lond.).

Arthur W. Crossley. Charles Gilling.
Chas. Horne Warner. Horace Finnemore.
G. T. Morgan.

Harding, Henry George Alan,
Darling Street, Chatswood, Sydney, N.S.W.

Teacher and Demonstrator of Chemistry, Sydney Technical College. Hold an Associateship (honours) in Chemistry, Syd. Tech. College (includes Physics, Mining, etc.). For several years Consulting and Analytical Chemist to such large firms as North Shore Gas Co., Ltd.; Plymel Enamel Co., Ltd.; J. C. Ludowici & Sons, Ltd.; and Messrs. F. Konig & Co., Ltd., Manufacturers. For some years now have held teaching position in Chemistry at Syd. Tech. College. Completed chemistry course (Science Faculty) at Sydney University, and am now doing post-graduate practical physical chemistry in Prof. Fawsitt's private laboratory. Author of "Notes on Halley's Comet," read before, and published by, the Royal Society of N.S.W., etc., etc.

Charles E. Fawsitt. F. A. Eastaugh.
J. A. Schofield. F. B. Guthrie.
Henry G. Smith.

Horne, William Joseph Chetwynd,
c/o Messrs. Cleeve Bros., Lansdowne, Limerick.

Analytical Chemist. Member of the Society of Public Analysts, Great Britain and Ireland.

Walter Thorp. Daniel J. O'Mahony.
Arthur W. Thorp. H. M. Atkinson.
Richard J. Moss.

Hough, Bernard Grindrod,

The Chestnuts, Wardle Road, Sale, Cheshire.

Analytical Chemist. Employed in the laboratory of Benger's Food, Ltd., Manchester. Member of the Pharmaceutical Society of Great Britain. I am desirous of keeping abreast of the current theories in Chemistry, and of the latest discoveries and investigations in the science.

Jas. Grant.
F. G. Richards.
Alfred Nixon.
Chas. Turner.
Stanley J. Peachey.
F. S. Sinnatt.
Wm. Beamont Hart.

Hurst, Reginald,

50, Culverley Road, Catford, S.E.

Chemist to The Float Electric Co., Ltd., Adam Street, S.E., also of Chemical Laboratory of above-mentioned Company.

Ernest Barrett.
A. G. Francis.
W. Mann.
S. Edward Sheppard.
R. W. Sindall.
Charles A. Keane.

Jenkin, William Alfred,

6, Bella Vista, Rio Tinto, Spain.

Chief Chemist, Rio Tinto Mines Laboratory; formerly Assayer and Analytical Chemist at Callington, Cornwall.

John Shields.
George A. Pingstone.
J. H. Pizey.
Robert J. Caldwell.
Robert Whymper.
William Robertson.

Laws, Ernyst Graham,

"Alverna," Edith Road, Ramsgate.

Teacher of Science. Headmaster for Further Education, Isle of Thanet. Late Demy of Magdalen College, Oxford. B.A. (Oxon). First Class Honours Natural Science (Chemistry), 1908. Research on "Isomerism of Acetaldehyde–Phenylhydrazone" (to be published shortly).

William Odling.
J. E. Marsh.
Allan F. Walden.
N. V. Sidgwick.
T. S. Moore.

McBain, James William,

71, Cotham Brow, Bristol.

Lecturer in Inorganic and Physical Chemistry, University of Bristol. B.A. and M.A. (Toronto); Ph.D. (Heidelberg). Published papers: *Journ. Phys. Chem.*, **5**, 623–638 (1901); *Zeitschr. f Elektrochemie*, **11**, 215, 961 (1905); *Trans. Chem. Soc.*, **91**, 1683

(1907); *Philosoph. Mag.*, (6), **18**, 916–935 (1909); Dissert., Rössler und Herbert, Heidelberg (1909); *Zeitschr. f. physikal. Chemie*, **68**, 471–497 (1909); December (1910); *Proc. Washington Acad. Sciences*, **9**, 1–78 (1907); *Univ. Toronto Studies*, No. 67 (1907); *Ber. d.d. chem. Ges.*, **43**, 321 (1910). Further, *Trans. Chem. Soc.*, **91**, 1683–1687 (1907); *Philosoph. Mag.*, (6), **20**, 793–828 (1910), etc.

Francis Francis. Philip J. Worsley.
F. W. Rixon. Edward Russell.
F. Wallis Stoddart.

Miller, John Watterson,

Lynwood, Cantilupe Street, Hereford.

Medical Officer of Health; Med. Supt., Isolation Hospitals; School Med. Officer, and Police Surgeon, City of Hereford. Student: Inter. B.Sc. in Chemistry, Vict. Univ.; Chemistry in D.P.H., Cambridge; at present carry out analyses of water and sewage effluents. "Filtration and other Methods of Purification, on a large scale, of River Water Used for Drinking Purposes" (*Public Health*, April, 1910).

Prosper H. Marsden. J. S. Smythe.
J. F. Haws. *W. Collingwood Williams.*
A. W. Titherley.

Moore, Walter Roman,

55, Gloucester Street, Norwich.

Demonstrator in Chemistry, Royal College of Science, South Kensington, S.W. Associate of the Royal College of Science.

T. E. Thorpe. James C. Philip.
M. O. Forster. W. Godden.
G. T. Morgan. Charles S. Garland.

Page, Harold James,

Avondale, Meteor Road, Westcliff-on-Sea.

Demonstrator in Physiological Chemistry, University College, London. Student from 1907 to 1910 at University College, London, Chemical Department. Joint paper with Dr. Smiles in *J.C.S.*, 1910 Vol. **97**.

William Ramsay. Samuel Smiles.
J. Norman Collie. W. Bradshaw Tuck.
A. J. Child.

Partington, Edward,

"Oakdene," Sedgley Park, Manchester.

Traveller in glues, gelatines, essences, soaps, etc., etc. Laboratory student: Chemistry, Physics, etc.

H. F. Coward. S. J. Peachey.
R. L. Taylor. F. S. Sinnatt.
F. G. Richards.

Peddle, Cyril James,

146, Barnsley Road, Cudworth, Nr. Barnsley.

Science Master, Grammar School. Degree of Master of Science, University of Sheffield. Joint author of paper on "Molecular Association in Aqueous Solution, Illustrated by Hydroxyl-containing Substances," read at British Association meeting at Sheffield, 1910.

W. Palmer Wynne. C. R. Young.
W. E. S. Turner. J. Kenner.
W. J. Jarrard. Ernest Witham.

Plews, Frank Henry,

28, Gellatly Road, St. Catherine's Park, S.E.

Head of Chemists' Manufacturing Department. Student, teacher and eight years in control of the manufacture of medicines, testing drugs, etc. Practical Chemistry—London College, Chamber of Commerce, etc. Reason for desiring admission: Chemistry is my daily work, also my recreation.

Ernest J. Parry. *William Stevenson.*
O. A. Elias. *W. H. Martindale.*
W. Chas. Sayers. *D. R. Boyd.*

Raper, Henry Stanley,

599, Spadina Avenue, Toronto, Canada.

Lecturer in Pathological Chemistry at the University of Toronto. Contributions to *Journal of Chemical Society*: (1) "Action of Sodium Hypochlorite on Benzenesulphonamides." (2) "Relation of Position Isomerism to Optical Activity, the Rotation of the Menthyl Esters of Chloro-, Bromo-, and Iodo-benzoic Acids," etc.

John Beresford Leathes. Julius B. Cohen.
Arthur Smithells. H. M. Dawson.
W. Lowson.

Stanford, Robert Viner,

Cardiff City Mental Hospital, Whitchurch, Glam.

Research Chemist to above institution. B.Sc. (Lond.); M.Sc. (Birm.); Ph.D. (Kiel); sometime a Priestley Research Scholar in the University of Birmingham.

Alex. McKenzie. Claude M. Thompson.
G. W. Clough. E. P. Perman.
Robt. D. Abell.

Summers, George Douglas,

Grammar School, Tideswell, Nr. Buxton. Home address Easington Lodge, Sproughton, Ipswich.

Assistant Master. Intermediate Science, London University, July 1907.

W. G. Boul. Thos. Sutcliffe.
E. A. Tyler. *William Jago.*
R. H. Aders Plimmer.

Thomson, David,

Viewpark, Letham Road, Strathaven, Scotland.

Assistant to Professor of Chemistry, Glasgow University. M.A., B.Sc., with special distinction in Chemistry, of Glasgow University, 1906. Ph.D. of Göttingen University, 1909. Late Robert Donaldson, Carnegie, and 1851 Exhibition Research Scholar in Chemistry. Since October, 1909, Assistant in the Organic Chemistry Department of Glasgow University. In December, 1910, appointed Professor of Chemistry in the Cotton College, Gauhati, Province of Eastern Bengal and Assam, India. Joint-author with Dr. T. S. Patterson of two papers on "The Influence of Solvents on the Rotation of Optically Active Compounds" (*Ber.*, 1907, 40, 1243; *Journal Chemical Society*, 1908, 93, 353). Author of "A Contribution to the Study of Tanacetone (β-Thujone)" (*Journal Chemical Society*, 1910, 97, 1502).

T. S. Patterson. Frederick Soddy.
John Ferguson. Cecil H. Desch.
Thomas Gray.

Verschoyle, Wiliam Denham,

15, Winch Building, Vancouver, B.C.

Mining Engineer. Work on "The Periodic Relations of the Elements," published in the *Chemical News*, May 8, 1908; *English Mechanic*, Sept. 18, 1908, and other articles.

W. Norman-Bott Henry Boyers.
James H. Pizey. *Henry Isaac Gorman.*
F. E. Matthews.

Waygood, Bertie James,

39, Marshall Road, Levenshulme, Manchester.

Chemist. Because my sole occupation is the analysis of Oils and Fats and their allied products. I hold a First Class Honours Certificate City and Guilds of London Institute for Oils and Fats, including candle manufacture.

Harcourt H. Phillips. J. Allan.
E. L. Rhead. *James Grant.*
Stanley J. Peachey.

Wink, Ian Gordon Sellar,

27, Panmuir Road, Cottenham Park, Wimbledon, S.W.

Manager of the Chemical Department, London Branch, China and Japan Trading Co. Was a pupil of the late Mr. John A. Wink, Manufacturing Chemist. Has taken much practical interest in the standards of purity for exported chemicals, and has made various contributions on this subject to English and Japanese journals.

John C. Umney.	Peter MacEwan.
Thomas Tyrer.	*Henry E. Stevenson.*
Ernest J. Parry.	*B. E. R. Newlands.*

Wood, Edward Escott,

Hurricane House, Brymbo, N. Wales.

Chemist and Metallurgist. Six years Chemist and Metallurgist to Brymbo Steel Co., Ltd. ; 3 years Senior Assistant Chemist to Messrs. Armstrong, Whitworth & Co., Ltd., Manchester ; 5 years Assistant Chemist, Cammell Laird & Co., Ltd., Sheffield.

H. Proctor Smith.	F. S. Sinnatt.
E. L. Rhead.	S. J. Peachey.

Jas. Grant.

Yates, Charles Fursdon,

"Ronaldene," Witham Rd., Isleworth.

Analytical Chemist, A. and F. Pears' Soap Works, Isleworth. *Perfumery and Essential Oil Record*, July 1910, article on "Cassia Oil." Student, Technical College, Finsbury, Chemical Dept., 1896–1899. Now engaged in manufacture, as above.

J. N. Goldsmith.	Clayton Beadle.
C. T. Bennett.	*John C. Umney.*

Henry P. Stevens.

The following Certificates have been authorised by the Council for presentation to Ballot, under Bye-law I. (3) :

Acree, Solomon Farley,

Johns Hopkins University, Baltimore, Ind., U.S.A.

Associate Professor of Chemistry, Johns Hopkins University, Baltimore. Associate Professor of Chemistry in the Johns Hopkins University. Formerly Associate Professor in the University of Utah. Author of about fifty articles on various chemical subjects in the

Berichte der deutschen chemischen Gesellschaft, American Chemical Journal, Journal of American Chemical Society, etc.

Ira Remsen.	*W. H. Perkin.*
F. W. Clarke.	*R. Robinson.*
Charles E. Munroe.	*Arthur Lapworth.*

Emerson, Robert Leonard, A.B., M.D. (Harvard),
Boston, Mass., U.S.A.

Analytical and Medical Chemist; Medico-Legal Expert. Author of "Über das Auftreten von Oxyphenylaethylamin bei Pankreasverdauung und über fermentative CO_2-Abspaltung," in *Beiträge z. chem. Phy. u. Path.*, Bd. I., 1901 (501). Author of Vol. II. "Wharton and Stille's Medical Jurisprudence." Author of book entitled "Legal Medicine and Toxicology." Instructor in Physiological Chemistry at Harvard University Medical School, 1901–05. Assistant in Clinical Pathology, Boston City Hospital, 1902–07.

John W. Smith.	*J. M. Crafts.*
Leonard P. Kinnicutt.	*T. Lynton Briggs.*
	E. G. Love.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C. AND BUNGAY, SUFFOLK.

Issued 27/2/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 382.

Thursday, February 16th, 1911, at 8.30 p.m., Professor HAROLD DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. S. Judd Lewis and Walter N. Haworth were formally mitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Samuel James Manson Auld, D.Sc., Ph.D., 65, Margery Park Road, Forest Gate, E.
Arthur Stewart Bowyer, M.Sc., The Woodlands, Chelford.
Cecil Reginald Crymble, B.Sc., 7, Upper Crescent, Belfast.
Oliver Statham Douse, B.Sc., Fern Bank, Glossop.
Alfred Henry Finniss-Wheldon, 446, Currie Road, Durban, Natal, S. Africa.
Henry Francis Harwood, M.Sc., Ph.D., Erlesdene, Park Road, Hale.
Thomas Riley Lucas, No. 3 Cantonments, Vizianagram, Madras, India.
Roney Forshaw Messervy, 73, Blenheim Crescent, W.
John Lawrence Robinson Pastfield, B.A., Olivevale, St. Thomas, Exeter.
Richard Garnet Penney, 40, Duesbery Street, Hull.
Robert Wright, M.A., Lauriston, Derryvolgie Avenue, Belfast.

The President announced that the Council had recommended the following gentlemen as Honorary and Foreign Members, and that a ballot for their election would be held at the next Ordinary Scientific Meeting of the Society:

Prof. Dr. Eugen Bamberger (Zürich).
Prof. Giacomo Ciamician (Bologna).
Prof. Dr. Paul Heinrich Ritter von Groth (Munich).
Prof. John William Mallet (Virginia).
Prof. Dr. Walther Nernst (Berlin).

It was stated that the following changes in the Officers and Council were proposed by the Council:

President to retire.—Prof. H. B. Dixon.

Vice-Presidents to retire.—Dr. J. J. Dobbie and Prof. F. S. Kipping.

Ordinary Members of Council to retire.—Mr. J. L. Baker, Dr. G. T. Beilby, Dr. J. T. Hewitt, and Dr. H. R. Le Sueur.

As President.—Prof. Percy F. Frankland.

As Vice-Presidents who have filled the office of President.—Prof. H. E. Armstrong, Prof. A. Crum Brown, Sir William Crookes, Sir James Dewar, Prof. H. B. Dixon, Dr. A. G. Vernon Harcourt, Prof. R. Meldola, Dr. H. Müller, Prof. W. Odling, Sir William Ramsay, Prof. J. Emerson Reynolds, The Right. Hon. Sir Henry E. Roscoe, Sir Edward Thorpe, and Sir William Tilden.

As Treasurer.—Dr. Alexander Scott.

As Hon. Secretaries.—Prof. Arthur W. Crossley and Dr. G. T. Morgan.

As Foreign Secretary.—Dr. Horace T. Brown.

As Vice-Presidents.—Dr. G. T. Beilby, Dr. J. N. Collie, Dr. M. O. Forster, Prof. A. Liversidge, Prof. W. J. Pope, and Prof. J. Walker.

As New Ordinary Members of Council.—Mr. W. R. Bousfield, Mr. C. F. Cross, Mr. A. R. Ling, and Dr. H. Marshall.

Dr. V. H. Veley, Dr. F. B. Power, and Prof. J. Millar Thomson were elected Auditors to audit the Society's accounts.

The President announced that Mr. G. H. Gabb had presented to the Society a portrait of Dr. John Jeffries, from the pastel by John Russell, R.A.

A ballot for the election of Fellows was held, and the following were subsequently declared elected:

Solomon Farley Acree.
James Allan, M.A., B.Sc.
Edward Anderson.
Albert Ashe.
John Ewart Trounce Barbary.
Joseph Bate.
Joseph Mayson Blackburn.
Walter Norman Burbridge.
John Fisher Carmichael, B.Sc.
Harold Christopher, B.Sc.
Morris Cutner, B.Sc.
James Edward A. Devlin.
Harold Edgar Dryden.
James Furnival Eardley.
Robert Leonard Emerson, A.B., M.D.
Michael Angelo Fielding.
William Temple Gardner.
Evan Dalton Griffiths, B.Sc.
Arthur Bennett Hall.
Charles Herbert Hampshire, B.Sc.
Henry George Alan Harding.
William Joseph Chetwynd Horne.
Bernard Grindrod Hough.
Reginald Hurst.
William Alfred Jenkin.
Ernyst Graham Laws, B.A.
James William McBain, M.A., Ph.D.
John Watterson Miller.
Walter Roman Moore.
Harold James Page.
Edward Partington.
Cyril James Peddle, M.Sc.
Frank Henry Plews.
Henry Stanley Raper.
Robert Viner Stanford, M.Sc., Ph.D.
George Douglas Summers.
David Thomson, M.A., B.Sc. Ph.D.
William Denham Verschoyle.
Bertie James Waygood.
Ian Gordon Sellar Wink.
Edward Escott Wood.
Charles Fursdon Yates.

Of the following papers, those marked * were read:

*40. "Different methods of applying the Grignard reagents." By Harold Davies and Frederic Stanley Kipping.

Attention was drawn to the fact that in many of the syntheses which involve the use of a Grignard compound, the preliminary preparation of an ethereal solution of this reagent is quite unnecessary, because the desired result may be attained by Barbier's method. It was shown by examples that tertiary alcohols may be obtained by mixing a ketone (not acetone, however) or an ester with an alkyl or aryl halogen compound, and then adding the mixture to magnesium in presence of ether; the formation of hydrocarbons (diphenyl, dibenzyl) as by-products, which is often a source of much trouble in using the magnesium aryl halogen compounds, is thus avoided. The method has been previously adopted in preparing certain silicon compounds (*Trans.*, 1908, **93**, 2006; 1909, **95**, 306), and, as was shown, may also be employed in the synthesis of alkyl derivatives of tin.

DISCUSSION.

Dr. ALEX. MCKENZIE referred to the preparation of the Grignard reagent from an aryl halide in the ordinary manner, when the main reaction is accompanied by the secondary reaction, $XR + RMgX = R \cdot R + MgX_2$; thus diphenyl was formed during the preparation of magnesium phenyl bromide. Such hydrocarbons were not always readily separated from the reaction products, but the extent of their formation might be lessened by the device suggested by Schmidlin, who recommended the use of an excess of magnesium amounting to from twice to thrice the calculated quantity.

*41. "Molecular association and its relationship to electrolytic dissociation. The molecular complexity of halogen-containing compounds." By William Ernest Stephen Turner.

The investigation was undertaken with the object of defining the conditions under which molecular association of halogen-containing compounds takes place, and to test whether such association could be attributed to the possession by the halogen atom of latent or residual valencies. The experimental work involved the examination, in indifferent solvents, of about sixty different substances, and information concerning other substances was collected from different sources. More than a hundred substances of different types, including salts, were inspected in the complete review.

The question of the molecular complexity of salts was approached through the halogen salts of organic nitrogen, oxygen, and sulphur bases, many of these salts being found soluble in chloroform. The information then obtained was applied to the metallic salts.

The chief conclusions were:

1. Molecular association of chlorine-containing compounds only occurs when the compound is electrically active, that is, is either an electrolyte or a conducting medium.

2. The degree of association in chloroform of the salts of organic bases is very high, the association factors ranging in different salts from about 1·5 to 12, in solutions which seldom exceed 10 per cent. Chlorides were always least, and iodides most associated. When salts of similar bases are compared, the degree of association decreases with the mass of the base.

3. With metallic salts, the iodides are least associated, and chlorides most. In salts derived from allied metals, the degree of association decreases with increase of the atomic weight, and increases with the electropositive character of the metal.

4. Molecular association is the complement of electrolytic dissociation. Substances dissociated in ionising media are associated in different solvents.

5. Latent valencies do not give rise to association, at least

directly. It is better to view association in connexion with the electrical properties of the substance.

Discussion.

Sir W. Ramsay drew attention to the fact that possibly chloroform as a solvent might exert "latent valencies," or "residual valencies," due to the possibility of chlorine acting not merely as a monad, but as a triad.

He also added that the main objection to the idea of "molecular compounds" was that molecules, as such, could not conduct; that molecules did not act as carriers of electricity: that property belonged exclusively to ions. Hence valency must be a property of ions, not of molecules, if there was any truth in the hypothesis that valency is due to the transit of electrons from one atom to another.

Dr. Philip drew attention to the fact that the molecular weight of ethyl alcohol in benzene, calculated from cryoscopic observations on 12 to 15 per cent. solutions, was four or five times the normal value, whereas the association factor of pure ethyl alcohol was about 3. He asked if Dr. Turner could offer any explanation of this difficulty.

Mr. Turner stated, in reply to Sir William Ramsay, that the possible combination of solvent and solute had been considered, but no evidence had been obtained during the investigation that such combination occurred. Moreover, in all cases, so far as the author was aware, combination between solvent and solute resulted, not in raising, but in *lowering* the molecular-weight values.

In reply to Dr. Barger, he considered that the use of pyridine as a solvent in the determination of molecular weights was objectionable for two reasons. It had a fairly high dielectric constant, and it combined with the solute.

With reference to Dr. Philip's question, the author could offer no plausible suggestion why alcohol should be so much more associated in benzene solution than in the liquid state.

In reply to Dr. Senter, Mr. Turner stated that the molecular complexities quoted of the haloid salts of the alkali metals were calculated by Walden by means of a formula which was free from the objections raised against the original Ramsay and Shields' formula. The results were also in accord with values obtained by a second method not involving a measurement of surface tension.

*42. "*α-p*-Hydroxy-*m*-methoxyphenylethylamine, and the resolution of *α-p*-hydroxyphenylethylamine." By Charles Watson Moore.

The author has prepared *α*-p-*hydroxy*-m-*methoxyphenylethylamine* by the reduction of 4-hydroxy-3-methoxyacetophenoneoxime. The base is found to have a slight action on the blood pressure. The *hydrochloride* and the *benzoyl* derivatives have also been prepared and characterised.

α-p-Hydroxyphenylethylamine was prepared by Tutin, Caton, and Hann (*Trans.*, 1909, **95**, 2113), and was shown (*loc. cit.*) to exert an action on the blood pressure similar to, although much less than, epinephrine. Since the base contains an asymmetric carbon atom, it was considered of interest to ascertain whether the optically active bases, obtained by its resolution, would differ in physiological activity, as in the case of the *d*- and *l*-epinephrines (Cushny, *Pharm. J.*, 1909, **82**, 56), and the *d*- and *l*-hyoscyamines (Cushny, *J. Physiol.*, 1904, **30**, 176). The base has been resolved by means of its d-*camphorsulphonate*, although only the salt of the lævorotatory base has been obtained in a pure condition. Optically pure benzoyl derivatives have, however, been obtained from both the stereoisomeric bases. The effect on the blood pressure of the *l*- and *dl*-bases has been determined, but no difference in physiological activity was observed.

43. "The formation and reactions of imino-compounds. Part XV. The production of imino-derivatives of piperidine leading to the formation of the ββ-disubstituted glutaric acids." By Ferdinand Bernard Thole and Jocelyn Field Thorpe.

It was shown that almost quantitative yields of the ββ-disubstituted glutaric acids can be obtained by condensing cyanoacetamide with ketones in the presence of piperidine or alkali hydroxide. The imino-piperidones which are initially formed decompose under the action of strong acids, yielding the substituted glutaric acids (compare *Proc.*, 1910, **26**, 295).

44. "The interaction of copper and nitric acid in presence of metallic nitrates. Part II." By Edward Henry Rennie and William Ternent Cooke.

The authors find that whereas in previous experiments at 59° and with 2*N*-acid, potassium nitrate had apparently no effect, and rubidium and cæsium nitrates a retarding effect on the dissolution of copper in dilute nitric acid, all these nitrates have either an accelerating or retarding effect according to the conditions of temperature and concentration. With the same concentration of acid, and with potassium nitrate, the lower the temperature the less is the acceleration (it often becomes retardation), whereas the higher the temperature, the greater is the acceleration. With the same temperature, increase of concentration of acid tends to lessen acceleration. These statements seem also to hold good with rubidium and cæsium nitrates. The authors also find that the effect of the increase of volume of acid due to the solution in it of considerable quantities of nitrates is a factor not to be overlooked, inasmuch as it obviously diminishes the concentration of the acid, and of nitrous acid or other products formed during the reaction. They conclude that these fresh results tend to confirm the opinions expressed by them in their previous paper (*Trans.*, 1908, **93**, 1162).

45. "The mechanism of Doebner and von Miller's quinaldine synthesis." By Humphrey Owen Jones and Percy Edwin Evans.

Doebner and von Miller's well-known synthesis of quinoline derivatives from an aldehyde and an aromatic amine by heating with hydrochloric acid is represented by the equation:

$$C_6H_5\cdot NH_2 + 2CH_3\cdot CHO = C_{10}H_9N + 2H_2O + H_2$$

in the simplest case.

The molecule of hydrogen is used up mainly in reducing some of the aldehyde.

During the examination of the aldol bases,

$$R\cdot NH\cdot CHMe\cdot CH_2\cdot CHO,$$

formed from *m*-4-xylidine and similar amines (Jones and White, *Trans.*, 1910, **97**, 632), the transformation of these into quinoline derivatives by heat or by acids in the cold was studied, and was found to take place without perceptible evolution of gas.

The aldol bases cannot be reduced by nascent hydrogen, and the change was therefore further examined. It was found that no gas was evolved, and that the transformation of the aldol base from *m*-4-xylidine at 140—250° is represented by the following equation:

$$2C_6H_3Me_2\cdot NH\cdot CHMe\cdot CH_2\cdot CHO = C_9H_4Me_3N + C_9H_8Me_3N + 2H_2O.$$

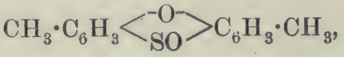
The change is practically quantitative, equimolecular quantities of 2 : 6 : 8-trimethylquinoline (m. p. 45—46°) and 2 : 6 : 8-trimethyltetrahydroquinoline (m. p. 50—51°, b. p. 260—261°) being produced.

Similar results have been obtained with *p*-toluidine. The synthesis of these quinoline and tetrahydroquinoline derivatives can be effected in this way, namely, by isolating the intermediate aldol base and heating it, much more cleanly and economically than by the usual method.

46. "A synthesis of derivatives of phenothioxin."

By Thomas Percy Hilditch and Samuel Smiles.

The ethers of *p*-cresol and *p*-chlorophenol sulphoxides show the normal reactions of the thionyl group in sulphuric acid solution, whilst the corresponding hydroxy-sulphoxides do not. This abnormal behaviour is due to the formation of the cyclic phenothioxin derivatives, for example:



$$CH_3{\cdot}C_6H_3{<}\begin{matrix}\text{-O-}\\ SO\end{matrix}{>}C_6H_3{\cdot}CH_3,$$

which have been isolated. The general character of the phenothioxin group was discussed.

47. "The nitration of acetylbenzoin and of stilbenediol diacetates."

By Arthur Gordon Francis and Charles Alexander Keane.

Acetylbenzoin, on nitration with fuming nitric acid at 0°, yields a *mononitro*-compound, which is also obtained when the nitration is carried out at −15° in acetic anhydride solution by means of nitre and sulphuric acid. It forms almost colourless leaflets, melting at 125° (uncorr.). It is sparingly soluble in ether or light petroleum, readily so in chloroform, acetone, or benzene, and somewhat less soluble in boiling 90 per cent. alcohol. When oxidised with sulphuric acid and potassium dichromate, it yields molecular proportions of acetic acid, benzoic acid, and *p*-nitrobenzoic acid. It has thus the following structure:

$$\underset{(1)}{NO_2}{\cdot}C_6H_4{\cdot}\underset{(4)}{CH}(OAc){\cdot}CO{\cdot}C_6H_5.$$

Hydrolysis with acids or alkalis yields, not nitrobenzoin, but condensation compounds, which are under further investigation.

Both α-stilbenediol diacetate (melting point 153°) and β-stilbenediol diacetate (melting point 110°), on nitration at −15° in acetic anhydride solution with nitre and sulphuric acid, yield benzoin mononitrate and a small quantity of a substance, possibly nitrobenzoin, melting at 188°, whilst β-stilbenediol diacetate is at the same time partly converted into the α-compound. No benzoin nitrate is formed at 0° or at −25°.

Benzoin mononitrate, $C_6H_5{\cdot}CH(O{\cdot}NO_2){\cdot}CO{\cdot}C_6H_5$, crystallises from 90 per cent. alcohol in brilliant white plates, melting at 167° (uncorr.). It is very sparingly soluble in ether or light petroleum. On hydrolysis with potassium hydroxide, it yields benzoin and potassium nitrate, and on heating with concentrated nitric acid benzil is formed.

48. "Experiments on the formation of 4(or 5)-β-aminoethylglyoxaline from histidine." By Arthur James Ewins and Frank Lee Pyman.

It has been found that by heating histidine (monohydrochloride) with (*a*) concentrated hydrochloric acid, (*b*) dilute (20 per cent.) sulphuric acid, and (*c*) potassium hydrogen sulphate in closed vessels at 265—270°, a maximum yield of 20 to 25 per cent. of the theoretical amount of the base, 4(or 5)-β-aminoethylglyoxaline (formed from histidine by removal of carbon dioxide), can be obtained. At temperatures below 240° no formation of the base takes place, whilst at 240—250° the main product of the reaction is racemic histidine.

By directly heating histidine above its melting point, only very small amounts of the base are produced. Somewhat better results were obtained by fusing the monobenzoyl derivative of histidine at about 240° in a vacuum and subsequently hydrolysing the reaction product.

Some new salts of racemic histidine, or 4(or 5)-β-aminoethylglyoxaline, and the dipicrate of natural histidine were described.

49. "The dissociation of cupric bromide, and some forms of glass manometer." By Colin Gyrth Jackson.

Three varieties of glass manometer were described, whereby it is possible to measure pressures of vapours in contact with no other material. Values of the dissociation pressure of cupric bromide at a series of temperatures were given, and their connexion shown to be adequately represented by an equation involving the constancy of the heat of dissociation, the applicability of the simple gas laws to bromine under the conditions of the experiment, and the first and second laws of thermodynamics.

50. "The determination of the dissociation pressures of hydrated salts by a dynamical method." By James Riddick Partington.

An account was given of experiments on three hydrates, in which the dissociation pressures have been measured by a dynamical method. The results were shown to be in agreement with the view referred to in a previous communication (this vol., p. 12).

51. "The influence of conjugated linkings on general absorptive power. Part I. The absorption spectra of some benzene derivatives." By Cecil Reginald Crymble, Alfred Walter Stewart, Robert Wright, and William Gerald Glendinning.

An examination of the absorption spectra of twenty-eight benzene derivatives (supported by a similar investigation of about the same number of aliphatic and alicyclic substances) has shown that it is possible to trace some connexion between the chemical structure of an unsaturated carbon compound and its general absorptive power. Of two isomeric substances containing two or more double bonds, the compound the molecule of which contains the longest chain of conjugated linkings appears to have the greater power of general absorption in the region of the spectrum above that in which any absorption band makes its appearance. In the case of two isomeric substances like atropic and cinnamic acid, the isomeride, which contains what Thiele terms "crossed double bonds" (for example, atropic acid), will have less absorptive power than the isomeride which contains a simple conjugated system of linkings, such as occurs in cinnamic acid. It was pointed out that this rule will furnish additional assistance in the determination of the constitutions of terpenes containing two double bonds the relative positions of which are difficult to ascertain.

52. "The optical properties of acids containing three hydrocarbon residues directly attached to an asymmetric carbon atom. Part I. The synthesis of β-phenyl-β-methylvaleric acid and of *as*-methylethylsuccinic acid." By John Kenneth Harold Inglis.

Compounds containing an asymmetric carbon atom might be expected to be very stable when subjected to the action of racemising agents. In order to investigate this question, *β-phenyl-β-methylvaleric acid*, $CMePhEt{\cdot}CH_2{\cdot}CO_2H$, has been prepared, but as the substance is a liquid, and its salts are difficult to crystallise, it is not a suitable substance for this purpose. *as*-Methylethylsuccinic acid, however, is crystalline, and can be obtained fairly easily by the method used by Higson and Thorpe (*Trans.*, 1906, **89**, 1467). Methyl ethyl ketonecyanohydrin condenses with the sodium derivative of cyanoacetic ester to give a liquid boiling at 165°/19·5 mm., which has the formula $C_{10}H_{14}O_2N_2$. This liquid gives *as*-methylethylsuccinic acid on hydrolysis. The acid has been resolved by crystallisation of its quinine salt.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Redgrove, *Herbert Stanley.* On the calculation of thermo-chemical constants. pp. viii + 102. London 1909. (*Recd.* 19/1/11.)
From the Author.

Redwood, *Sir Boverton.* Petroleum. A treatise on the geographical distribution and geological occurrence of petroleum and natural gas; the physical and chemical properties, production, and refining of petroleum and ozokerite; the characters and uses, testing, transport, and storage of petroleum products; and the legislative enactments relating thereto; together with a description of the shale oil and allied industries; and a full bibliography. 2 vols. pp. xxxii + 1064. ill. London 1906. (*Recd.* 25/1/11.) From the Author.

Richter, *Victor von.* Traité de chimie organique. Edited by *R.* **Anschütz** and *G.* **Schrœter.** Translated into French by *H.* **Gault.** Vol. I. pp. xxiv + 886. Paris 1910. (*Recd.* 24/1/11.)
From the Publisher: M. Ch. Béranger.

II. *By Purchase.*

Allen, *Alfred Henry.* Commercial organic analysis. Vol. IV. 4th edition. Edited by *W. A.* **Davis** and *Samuel S.* **Sadtler.** pp. viii + 466. ill. London 1911. (*Recd.* 21/1/11.)

Dictionary (An [explanatory) of the apparatus and instruments employed in the various operations of philosophical and experimental chemistry. With seventeen quarto copper-plates. By a Practical Chemist. pp. vii + 296. London 1824. (*Recd.* 20/1/11.)

Gmelin, *Leopold,* and **Kraut,** *K.* Handbuch der anorganischen Chemie. 7th edition. Edited by **Friedheim,** *C.*, and **Peters,** *Franz.* Vol I., etc. Heidelberg 1905 + *Reference.*

III. *Pamphlets.*

Clacher, *William.* The manufacture of carbons. (From the *Electrical Review,* 1911, **68.**)

Gabb, *George Hugh.* A recently-discovered portrait of Dr. Jeffries, by J. Russell, R.A. (From the *Connoisseur,* 1911, **29.**)

Meldola, *Raphael.* Evolution: Darwinian and Spencerian. The Herbert Spencer Lecture . . . 1910. pp. 44. Oxford 1910.

Philippine Islands. The mineral resources of the Philippine Islands. With a statement of the production of commercial mineral products during the year 1909. pp. 81. ill. Manila 1910.

Queensland. Report of the Agricultural Chemist for the year ending 30th June, 1910. pp. 23. ill. Brisbane 1910.

Seidell, *Atherton.* The solubilities of the pharmacopœial organic acids and their salts. pp. 98. Washington 1910.

Taffanel, *J.* Abstract of the reports of the French coaldust experiments conducted at the Liévin Experimental Station, 1907–10. Abstracted and translated by the "Colliery Guardian." pp. 82. ill. London 1910.

Zenneck, *J.* Die Verwertung des Luftstickstoffs mit Hilfe elektrischen Flammenbogens. pp. 29. ill. Leipzig 1911.

At the next Ordinary Scientific Meeting, on **Thursday**, March **2nd**, 1911, at **8.30** p.m., there will be a ballot for the election of Honorary and Foreign Members, and the following papers will be communicated:

"Potassium cupricarbonates." By S. U. Pickering.

"Studies in the camphane series. Part XXIX. A new phenylhydrazone of camphorquinone." By M. O. Forster and A. Zimmerli.

"Synthesis of dipeptides of lauric acid with glycine, alanine, valine, leucine, and asparagine." By A. Hopwood and C. Weizmann.

"Fluorone derivatives." By F. G. Pope and H. Howard.

"The constituents of *Witharia somnifera.*" By F. B. Power and A. H. Salway.

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Issued 13/3/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 383.

Thursday, March 2nd, 1911, at 8.30 p.m., Professor Harold B. ixon, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. Frank H. Plews, C. F. Yates, and Thomas Callan were ormally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Alfred Thomas Eggington, B.Sc., The Hawthorns, Ibstock, Leicester.
Arthur Alfred Eldridge, B.Sc., School House, Alpha Road, Surbiton Hill.
Edwin Burnhope Hughes, 5, Perham Road, West Kensington, W.
Leonard Owen Newton, St. Elba, Napoleon Road, St. Margaret's-on-Thames.
Eric Everard Walker, 210, Bedford Hill, Balham, S.W.
Henry Hough Watson, Braystones, via Carnforth.
William Wood, Katoomba, King Edward Avenue, Dartford.

A ballot for the election of Honorary and Foreign Members was eld, and the following were subsequently declared duly elected:

Prof. Dr. Eugen Bamberger (Zürich).
Prof. Giacomo Ciamician (Bologna).
Prof. Dr. Paul Heinrich Ritter von Groth (Munich).

Prof. John William Mallet (Virginia).
Prof. Dr. Walther Nernst (Berlin).

The President announced that the Royal Academy of Sciences of Turin had given notice of the founding of a Vallauri Prize of 26,000 lire for the most important work in the domain of the physical sciences published during the period January 1st, 1915, to December 31st, 1918.

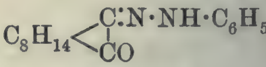
The President read the names of the Fellows recommended by the Council for election as Officers and Ordinary Members of Council for the year 1911 to 1912.

Of the following papers, those marked * were read:

*53. "Studies in the camphane series. Part XXIX. A new phenylhydrazone of camphorquinone." By Martin Onslow Forster and Adolf Zimmerli.

The constitution of camphorquinonephenylhydrazone has been the subject of much speculation. Following their investigation of the hydrazones, semicarbazones, and phenylcarbamylhydrazones of camphorquinone, each of which was obtained in two interconvertible isomeric modifications, the authors have transformed the known camphorquinonephenylhydrazone into an isomeride, which stands in the same relation to the existing derivative as the β-members of the other pairs do to the respective α-compounds; they regard the isomerism as stereochemical.

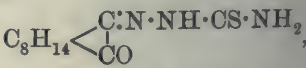
Camphorquinone-β-phenylhydrazone,



$C_8H_{14}<\begin{matrix}C:N\cdot NH\cdot C_6H_5\\ | \\ CO\end{matrix}$,

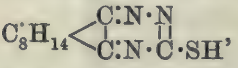
prepared by heating the α-modification, is a bright yellow, crystalline substance, melting at 36°; it dissolves very readily in organic media, including petroleum. The one per cent. solution in alcohol has $[\alpha]_D$ 375°, which is raised to 397° by heating the liquid during twelve hours at 63°; under the same treatment the rotatory power of the α-phenylhydrazone falls from $[\alpha]_D$ 431° to 398°.

Camphorquinone - α - thiosemicarbazone,



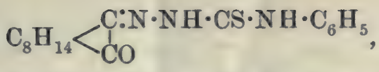
$C_8H_{14}<\begin{matrix}C:N\cdot NH\cdot CS\cdot NH_2\\ | \\ CO\end{matrix}$,

melts at 174°, but the β-modification could not be isolated, being transformed too rapidly into *camphane-thiotriazine*,



$$C_8H_{14}<\begin{matrix}C:N\cdot N\\ | \quad\quad || \\ C:N\cdot C\cdot SH\end{matrix}$$,

a bright yellow substance, melting at 207°. *Camphorquinonepheny!*

thiocarbamylhydrazone,  $C_8H_{14}\left<\begin{array}{l}C{:}N\cdot NH\cdot CS\cdot NH\cdot C_6H_5\\ \mid \\ CO\end{array}\right.$, prepared from both camphorquinonehydrazones and phenylthiocarbimide, melts at 184°.

Discussion.

The **President** asked whether there was any explanation of the great difference observed between the melting points of the α- and β-forms of the phenylhydrazone derivatives.

Mr. W. **Robertson** submitted that the isolation of a second form of camphorquinonephenylhydrazone of low melting point and high rotatory power was not necessarily at variance with the conclusion drawn from the mutarotation measurements that, in benzene solution, a labile form of practically no optical activity was present. The results could be harmonised by supposing the existence of three isomerides in alcoholic solution, the α-form (m. p. 190°) first undergoing a rapid change into a second form (this being the change examined in the non-ionising purified benzene), the second form then changing relatively slowly into the β-form (m. p. 36°), a conclusion supported by solubility measurements (*Trans.*, 1905, **87**, 1299).

It was also pointed out, in reply to Dr. Forster, that in Armstrong and Robertson's paper, the colouring material in solution was due to the complex: $\begin{array}{l}C{:}N\cdot NH\cdot C_6H_5\\ \mid \\ CO\end{array}$, and the opinion was expressed that the amount of this form present was small (*loc. cit.*, p. 1278).

Dr. **Veley** expressed the opinion that the observed differences in the algebraical sum of the factors of chemical change (namely, the values of $K+K_1$) were probably due to the presence of a small quantity of the β-hydrazone in the α-derivative, which accelerated the transformation of the former into the latter compound. The case would be perfectly analogous to the acceleration observed in the transformation of rhombic into monosymmetric sulphur, of cyanic acid into cyamelide, and of the oxidation of oxalic acid by acid permanganate as affected by the presence of manganese sulphate. The explanation thus offered was probably identical with that proposed by Prof. Walker, though stated in a somewhat different form.

Dr. **Lowry** supported the view that three isomeric hydrazones of camphorquinone must now be recognised, the ordinary form of the compound being converted quickly at atmospheric temperatures (to the extent of 10 per cent.) into an isomeride of very low rotatory power, and slowly at a higher temperature (to the extent of about 50 per cent.) into the new isomeride described by Dr. Forster. An analogous case was that of nitrocamphor, which changed quickly (to the extent of one-sixth) into the acidic pseudo nitro-compound, but could be forced to undergo a further change of the Beckmann type, giving rise to a third isomeride, namely camphoryloxime. Although the less stable isomerides could not be isolated, their existence in solution had been demonstrated by precisely the same methods as in the case of such well-known substances as gluconic and galactonic acids, which decomposed into lactone and water as soon as any attempt was made to separate them from their solutions.

Prof. GREEN remarked that the greater depth of colour of the β-isomeride, as compared with that of the α-isomeride, would be well explained by the *anti-* and *syn*-formulæ suggested by the authors, since the proximity of the NH group to the CO group in the *syn*-modification would favour a dynamic keto-enolic oscillation.

Dr. FORSTER, replying to the President, pointed out that the isomeric benzaldoximes melted at 35° and 128° respectively; moreover, the difference between the melting points of maleic and fumaric acids is 156°, greater therefore than that which separates the phenylhydrazones of camphorquinone. The necessity of now recognising three isomerides, claimed by Mr. Robertson and Dr. Lowry, was not accepted by the authors, who regarded Mr. Robertson's solubility experiments as capable of explanation by the new facts brought to light. Without denying that future investigation might reveal a third isomeride, it was difficult to recognise any justification for stating that it would be optically inactive. Dr. Forster agreed with Mr. Robertson's second point, namely, that in the latter's paper with Professor Armstrong, a material owing its colour to the complex $C{:}N{\cdot}NH{\cdot}C_6H_5$ was stated to be present in very small proportion, but reminded Mr. Robertson that the evidence furnished for its existence was limited to the bare statement of its occurrence; moreover, the yellow substance was entirely ignored in the later parts of their paper, which dealt only with the hypothetical, colourless "metameride having little, if any, optical activity."

*54. "Fluorone derivatives."

By Frank George Pope and Hubert Howard.

Phosphorus pentachloride converts 3-hydroxy-9-phenylfluorone into 3 : 6-*dichloro-9-phenylxanthonium chloride*, an extremely reactive compound, which condenses readily with amines to produce compounds of the rosamine type, with potassium cyanide and with sodium ethoxide to form cyanoxanthen and xanthyl ethers respectively. Reasons were given for preferring a paraquinonoid configuration for the fluorones; *phenylfluorone* and *phenylnaphthafluorone* were also described.

DISCUSSION.

Prof. GREEN said that the fluoran dyestuffs seemed to occupy an intermediate position between the ortho-quinonoid and the para-quinonoid dyestuffs, and from many facts he was disposed to believe that they were usually in a state of oscillation between the two forms, or that they readily changed from one form to the other. In certain cases, as had been shown for quinolphthalein by Green and King, an ortho-quinonoid structure must be assumed.

*55. "The constituents of Withania somnifera."

By Frederick Belding Power and Arthur Henry Salway.

The material employed for this investigation represented the entire plant of *Withania somnifera*, Dunal (Nat. Ord. *Solanaceae*), and was obtained directly from South Africa. Both the roots and the overground portion of the plant responded to the tests for an alkaloid, and they were separately examined.

The investigation has shown that a number of substances present in the root are likewise contained in the leaves and stems of the plant. These substances, besides small amounts of an essential oil and a sugar yielding *d*-phenylglucosazone, were as follows: hentriacontane, $C_{31}H_{64}$; a phytosterol, $C_{27}H_{46}O$; palmitic, stearic, cerotic, oleic, and linolic acids; and ipuranol, $C_{23}H_{38}O_2(OH)_2$. From the root there were obtained, furthermore, a new monohydric alcohol, *withaniol*, $C_{25}H_{33}O_4{\cdot}OH$, decomposing at 305°, and having $[\alpha]_D$ +91·2°, and an amorphous alkaloidal principle, which, on treatment with alkali hydroxides, yielded a crystalline *base*, $C_{12}H_{16}N_2$ (m. p. 116°). The leaves and stems yielded the following new compounds: a monohydric alcohol, *somnirol*, $C_{32}H_{43}O_6{\cdot}OH$, decomposing at 205°, and having $[\alpha]_D$ +34·8°; a dihydric alcohol, *somnitol*, $C_{33}H_{44}O_5(OH)_2$, decomposing at about 250°, and having $[\alpha]_D$ +21·2°; and an acidic, hydrolytic product, *withanic acid*, $C_{29}H_{45}O_6{\cdot}CO_2H$ (m. p. 226°), the *methyl* ester of which decomposed at 255°.

Withania somnifera, unlike some other solanaceous plants, contains no mydriatic alkaloid, and physiological tests, conducted on a dog, failed to confirm the sedative or hypnotic properties attributed to it.

*56. "The carbohydrate constituents of Pára rubber: separation of *l*-methylinositol." (Preliminary note.) By Samuel Shrowder Pickles and Bernard Wyndham Whitfeild.

During the examination of various specimens of smoked plantation rubber from the Malay Peninsula, the presence of a crystalline, sugar-like substance, melting at 191—192°, was detected in all cases. The amount of this constituent present in the different specimens varied considerably, being in some cases as high as 2·5 per cent. On analysis it gave the following results:

(1) 0·1674 gave 0·2648 CO_2 and 0·1035 H_2O. $C=43{\cdot}1$; $H=6{\cdot}9$.
(2) 0·2150 „ 0·3385 CO_2 „ 0·1350 H_2O. $C=42{\cdot}9$; $H=7{\cdot}0$.
0·2225 „ 0·2615 AgI. $OMe=15{\cdot}5$.
$C_6H_{11}O_5{\cdot}OMe$ requires $C=43{\cdot}3$; $H=7{\cdot}2$; $OMe=15{\cdot}96$ per cent.

This substance is lævorotatory; a 10 per cent. aqueous solution gave $\alpha - 8°$, whence $[\alpha]_D - 80°$. It does not reduce Fehling's solution, and is scarcely affected by prolonged boiling with moderately concentrated sulphuric or hydrochloric acids. Hydriodic acid decomposes it with the formation of methyl iodide and *l*-inositol (m. p. 237°).

The compound is thus *l*-methylinositol, and is identical with that isolated from quebracho bark by Tanret (*Compt. rend.*, 1889, **109**, 908), and designated quebrachite. Its presence has also been previously observed in the aqueous portion of the latex of *Hevea brasiliensis* which remains after the coagulation of the rubber, by de Jong (*Rec. trav. chim.*, 1906, **25**, 48).

The authors have also confirmed this observation by the examination of specimens of the latex of *Hevea brasiliensis* from the Botanic Gardens at Singapore, and have found that this substance (*l*-methylinositol) constitutes the greater portion of the carbohydrate constituents of the latex. They also find that the occurrence of *l*-methylinositol (quebrachitol) is quite general in rubbers from *Hevea brasiliensis*, and have isolated it, not only from those of Asiatic origin, but also from "fine hard Pára" rubber from South America.

Discussion.

Dr. Pickles stated, in reply to questions, that, although probably the *l*-methylinositol in the latex was not directly connected with the formation of rubber, its presence was worthy of note, and there was the possibility that under the influence of enzymes it might be converted into products which could be utilised by the plant for the construction of the rubber hydrocarbon.

57. "Potassium cupricarbonates." By S. U. Pickering.

Previous work on other cupri-compounds indicate the possibility of there being eight, or even more, compounds of potassium carbonate with copper carbonate; nine have been isolated. Potassio-cupric carbonate exists in a hydrated and anhydrous condition, the latter, however, not being the compound of the same empirical formula isolated by Reynolds (*Trans.*, 1898, **73**, 263). The β-cupricarbonate, $(CO_3)_2K_2Cu^{IV},H_2O$, forms a gelatinous precipitate; and a compound which appears to be derived from it by abstraction of the elements of water (indirectly) has been obtained. The other five compounds, which are all crystalline, are α-cupricarbonates (that is, containing the $Cu^{IV}CO_3$ group), with the formulæ: $[(CO_3)_3K_2Cu_2^{IV},Cu_2(CO_3)_2]$, $[(CO_3)_4K_4Cu_2^{IV},CuK_2(CO_3)_2]$, and $[(CO_3)_4K_4Cu_2^{IV},Cu_2K_2(CO_3)_3]$, with two other members derived from the last by the substitution of Cu for K_2.

Three of these substances have the empirical formula $CuK_2(CO_3)_2$, but are well distinguished from each other by their physical and chemical properties, and by their heats of formation. Several other organic acids apparently form cupri-compounds analogous to the cupricarbonates.

58. "Synthesis of dipeptides of α-aminolauric acid with glycine, alanine, valine, leucine, and asparagine." By Arthur Hopwood and Charles Weizmann.

In view of the possible presence of peptides of α-aminolauric acid with amino-acids in the proteins occurring in certain plants, the authors have prepared the following derivatives:

α-Bromolauryl chloride, $C_{11}H_{22}Br\cdot COCl$, is obtained by heating α-bromolauric acid with phosphorus pentachloride. It is a colourless liquid, boiling at 150°/10 mm.

α-Bromolaurylglycine, $C_{11}H_{22}Br\cdot CO\cdot NH\cdot CH_2\cdot CO_2H$, is prepared by the interaction of α-bromolauryl chloride and glycine in presence of sodium hydroxide. It forms colourless, rhombic plates, melting at 117·0° to 118·5°, which are only sparingly soluble in water, but readily so in alcohol, ether, benzene, toluene, or alkalis.

α-Aminolaurylglycine, $NH_2\cdot C_{11}H_{22}\cdot CO\cdot NH\cdot CH_2\cdot CO_2H$, is formed by heating α-bromolaurylglycine with concentrated aqueous ammonia. It crystallises in prismatic needles, which sinter at 207°, and melt and decompose at 214·0—214·5°. It is nearly insoluble in water, sparingly soluble in alcohol, but readily so in alkalis or acids. Like the proteins, it yields a white, amorphous precipitate with phosphotungstic acid, and is hydrolysed by enzymes.

Somewhat similar bromo-compounds are obtained by the condensation of α-bromolauryl chloride with alanine, valine, leucine, and asparagine, and these, on treatment with ammonia, yield the corresponding dipeptides.

59. "The occlusion of hydrogen by the palladium-gold alloys." By Arthur John Berry.

Determinations have been made of the quantities of hydrogen occluded by the palladium-gold alloys when charged electrolytically with hydrogen. With alloys in which the concentration of palladium exceeded about 25 per cent., the occluding power was found to be a simple function of the concentration of that metal. Alloys more dilute in respect to palladium do not possess the property of occluding any hydrogen.

60. "Synthesis of *dl*-3 : 4-dihydroxyphenylalanine." By Casimir Funk.

With the view of testing whether any relationship exists between tyrosine and adrenaline, a catechol derivative corresponding with tyrosine was prepared. The synthesis of this *dl*-3 : 4-*dihydroxyphenylalanine* was carried out according to the method originally suggested by Erlenmeyer. The cyclic carbonic ester of catecholaldehyde was condensed with hippuric acid, and the resulting azlactone saponified with sodium hydroxide; the substituted cinnamic acid which was formed was reduced with sodium amalgam, and the benzoyl group eliminated by boiling with hydrochloric acid. The amino-acid obtained gave all the ordinary chemical reactions of adrenaline. Experiments are now being conducted with the view of ascertaining the nature of the changes which this substance undergoes in the animal body.

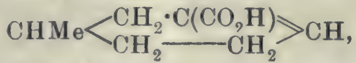
61. "The interaction of chlorine and carbon monoxide." (Preliminary note.) By David Leonard Chapman and Frank Houghton Gee.

It has been shown that the photochemical interaction of carbon monoxide and chlorine is inhibited by the same substances as those which prevent or retard the action between chlorine and hydrogen in light. Nitrosyl chloride almost prevents the union of carbon monoxide and chlorine when the mixed gases are exposed to a very intense light, and since it is not decomposed its action continues for an indefinite period.

Experiments have also been performed at higher temperatures; the gases combine slowly at 350°, and it is significant that light has no—or, at most, an inappreciable—influence on the rate of combination at this temperature. The inhibitors which have been tried, namely, nitrosyl chloride and oxygen, are also without effect on the pyrogenic union of the gases. The experiments are being continued over a wider range of temperature.

62. "Experiments on the synthesis of the terpenes. Part XVI. Resolution of *dl*-1-methyl-Δ^3-*cyclo*hexene-3-carboxylic acid. Synthesis of the *d*- and *l*-modification of Δ^3-*m*-menthenol(8) and $\Delta^{3:8(9)}$-*m*-menthadiene." By Bernard Dunstan Wilkinson Luff and William Henry Perkin, jun.

The authors have succeeded in resolving *dl*-1-methyl-Δ^3-*cyclo*hexene-3-carboxylic acid:

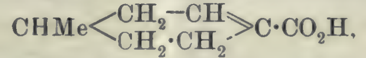


$$CHMe{<}\begin{matrix}CH_2\cdot C(CO_2H)\\ CH_2\text{———}CH_2\end{matrix}{>}CH,$$

by the use of brucine and *l*-menthylamine, whereby the synthesis of the *d*- and *l*-modification of Δ^3-*m*-menthenol(8) and $\Delta^{3:8(9)}$-*m*-menthadiene has been made possible.

63. "Experiments on the synthesis of the terpenes. Part XVI. *d*-Δ^3-*p*-menthenol(8) and d-$\Delta^{3:8(9)}$-*p*-menthadiene." By Tsan Quo Chou and William Henry Perkin, jun.

The preparation of *d*-1-methyl-Δ^3-*cyclo*hexene-4-carboxylic acid,



$$CHMe{<}\begin{matrix}CH_2\text{—}CH\\ CH_2\cdot CH_2\end{matrix}{>}C\cdot CO_2H,$$

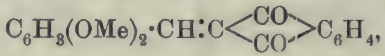
from *d*-1-methyl*cyclo*hexan-3-one was described. It has $[\alpha]_D + 150{\cdot}1°$, and yields the *d*-modification of Δ^3-p-*menthenol*(8) and $\Delta^{3:8(9)}$-p-*menthadiene* when its ester is treated with magnesium methyl iodide and subsequently with dehydrating agents.

64. "Some derivatives of *o*-veratraldehyde." (Preliminary note.) By William Henry Perkin, jun., Walter Morrell Roberts, and Robert Robinson.

o-Veratraldehyde, $(MeO)_2C_6H_3\cdot CHO[MeO : MeO : CHO = 1 : 2 : 3]$ is a substance of importance in connexion with the synthesis of alkaloids, and particularly of berberine. The authors have therefore prepared some of its more interesting derivatives.

o-Veratric acid, $C_6H_3(OMe)_2\cdot CO_2H$, is obtained on oxidation of the aldehyde in acetone solution with potassium permanganate. It is moderately readily soluble in hot water, and crystallises in needles, melting at 122°. Its methyl ester melts at 47°, and has also been prepared by Fritsch (*Annalen*, 1898, **301**, 356) by the methylation of guaiacolcarboxylic acid.

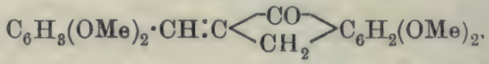
1 : 3-*Diketo*-2-o-*veratrylidenehydrindene*,



$$C_6H_3(OMe)_2{\cdot}CH{:}C<\begin{matrix}CO\\CO\end{matrix}>C_6H_4,$$

is prepared by heating together the aldehyde and diketohydrindene. It crystallises from alcohol in bright yellow needles, melting at 160°.

5 : 6-*Dimethoxy*-2-o-*veratrylidene*-1-*hydrindone*,



$$C_6H_3(OMe)_2{\cdot}CH{:}C<\begin{matrix}CO\\CH_2\end{matrix}>C_6H_2(OMe)_2.$$

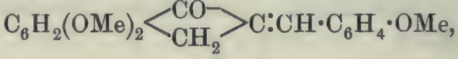
is obtained when a solution of equimolecular proportions of *o*-veratraldehyde and 5 : 6-dimethoxy-1-hydrindone in ethyl alcohol is treated with two or three drops of concentrated potassium hydroxide. The substance crystallises from alcohol in pale yellow needles, melting at 186°. When it is dissolved in sulphuric acid, an orange-coloured solution is obtained, which contains the anhydrosulphate of a pyranol base produced with loss of methyl alcohol.

2 : 3-*Dimethoxycinnamic Acid*, $C_6H_3(OMe)_2{\cdot}CH{:}CH{\cdot}CO_2H$.—This substance is best prepared by hydrolysis of the corresponding ethyl ester obtained by the condensation of *o*-veratraldehyde with ethyl acetate by means of sodium.

The acid separates from ethyl acetate in long, colourless needles, and melts at 180°. It shows the usual properties of a cinnamic acid, and is readily reduced by sodium amalgam, yielding 2 : 3-*dimethoxy-β-phenylpropionic acid*, $C_6H_3(MeO)_2{\cdot}CH_2{\cdot}CH_2{\cdot}CO_2H$, which crystallises from a mixture of benzene and light petroleum in prisms, melting at 69°.

4 : 5-*Dimethoxy*-1-*hydrindone*, $C_6H_2(OMe)_2<\begin{matrix}CO\\CH_2\end{matrix}>CH_2$, is produced in good yield when dimethoxyphenylpropionic acid is treated with phosphoric oxide in boiling benzene solution. It crystallises from ether or light petroleum in small, pale yellow plates, melting at 82°.

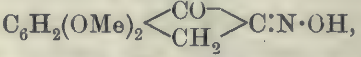
4 : 5-*Dimethoxy*-2-o-*anisylidene*-1-*hydrindone*,



$$C_6H_2(OMe)_2<\begin{matrix}CO\\CH_2\end{matrix}>C{:}CH{\cdot}C_6H_4{\cdot}OMe,$$

prepared by heating equimolecular proportions of anisaldehyde and 4 : 5-dimethoxy-1-hydrindone with potassium hydroxide in warm alcoholic solution, crystallises from acetic acid or ethyl alcohol in long, feathery needles, melting at 153—154°.

2-iso*Nitroso*-4 : 5-*dimethoxy*-1-*hydrindone*,



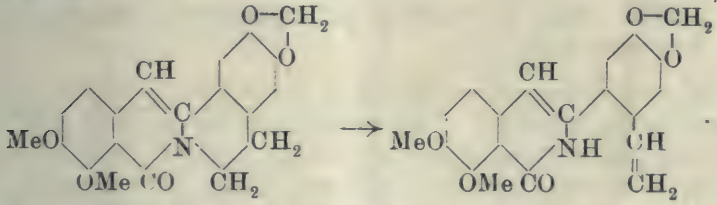
$$C_6H_2(OMe)_2<\begin{matrix}CO\\CH_2\end{matrix}>C{:}N{\cdot}OH,$$

is prepared by the action of amyl nitrite and a few drops of hydrochloric acid at 50° on the hydrindone dissolved in ethyl alcohol. It forms pale yellow needles, which melt and decompose at 244°, and is soluble in alkalis. On oxidation with potassium permanganate in alkaline solution, a good yield of hemipinic acid is obtained.

65. "*iso*Oxyberberine." (Preliminary note.) By Norman Bland, William Henry Perkin, jun., and Robert Robinson.

When oxyberberine is heated in an autoclave at 130° for five hours with dilute hydrochloric acid, it is converted into an isomeride to which the name iso*oxyberberine* is given.

The new substance is probably produced in accordance with the following scheme, which represents *iso*oxyberberine as a derivative of *iso*carbostyril:



*iso*Oxyberberine is much less soluble in glacial acetic acid than is oxyberberine, and crystallises from this solvent in pale, greyish-yellow microscopic needles, melting at 245°.

It gives a red azo-colouring matter when treated with alkali and diazotised sulphanilic acid, and a purplish-red colour with aqueous ferric chloride. It does not appear to have basic properties.

*Acetyl*iso*oxyberberine*, $C_{20}H_{16}O_5N(CO{\cdot}CH_3)$, is prepared by boiling *iso*oxyberberine with acetic anhydride and sodium acetate. It crystallises from acetic acid in needles, and melts at 261°.

*Nitroso*iso*oxyberberine*, $NO{\cdot}C_{20}H_{16}O_5N$, is prepared by shaking *iso*oxyberberine with a solution of amyl nitrite in glacial acetic acid for five hours in the cold. The compound is very sparingly soluble in most organic solvents, but can be recrystallised from hot pyridine, and occurs in highly characteristic, golden-brown, microscopic needles, melting at 263—265°. These and other derivatives of this substance are in process of detailed investigation.

66. "The application of viscometry to the measurement of rate of reaction." By Albert Ernest Dunstan and Albert George Mussell.

The authors have measured the viscosity of a variety of compounds undergoing chemical changes. They find that, in general, the viscosity changes with the lapse of time, in such a way that the total viscosity change is proportional to the amount of substance transformed. They consider that a useful method for the measurement of the velocity of reaction may be based on this observation. Accordingly, experiments have been made in which the rates of the following transmutations are measured:

Freshly distilled acetoacetic ester —> equilibrium mixture; aniline and ammonium thiocyanate —> phenylthiocarbamide; ammonium cyanate —> carbamide; ammonium thiocyanate —> thiocarbamide; acetic anhydride and water —> acetic acid; benzoyl chloride and water —> benzoic acid.

67. "The action of hydrogen sulphide on the alkyloxides of the metals. Part I. Sodium and potassium ethoxides." By Alexander Rule.

The author has undertaken this investigation in the hope of preparing the sulphides of aluminium, chromium, and ferric iron by precipitation from alcoholic solution. These sulphides cannot be prepared from aqueous solutions, owing to hydrolysis, and when obtained in the dry way they are always impure. As no record of the action of hydrogen sulphide on the alkyloxides of sodium or potassium could be discovered, this action was first investigated, and found to result in the formation of the pure anhydrous hydrosulphides of these metals, the compounds being precipitated from alcoholic solution on the addition of ether or benzene.

The reaction provides a very simple and rapid method for the preparation of the anhydrous hydrosulphides, and the yields are practically quantitative.

The behaviour of hydrogen sulphide towards the solid ethoxides of sodium and potassium was also investigated. Reaction was found to take place at the ordinary temperature, and resulted in the formation of the hydrosulphides of the metals and evolution of alcohol.

68. "Simple method of decomposing refractory tin ores." By Herbert Yabsley Loram.

The mineral (2 grams, or more if desired), crushed to a sixty-hole powder, is fused for about an hour in a covered silver crucible at a temperature well below its melting point, with about six or seven times its weight of potassium hydroxide, to which is added potassium cyanide equal to the weight of tin ore taken.

The mass, on cooling, is extracted with water, when the whole will dissolve in dilute hydrochloric acid, and after boiling to destroy any cyanide still remaining, the tin can be estimated by any of the usual methods.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Carré, *P.* Hydrocarbures, alcools et éthers de la série grasse. pp. 410. Paris 1911. (*Recd.* 15/2/11.)
From the Publishers: M. O. Doin et Fils.

Harden, *Arthur.* Alcoholic fermentation. pp. ix + 128. London 1911. (*Recd.* 21/2/11.) From the Author.

Hilditch, *Thomas Percy.* A concise history of chemistry. pp. ix + 263. London 1911. (*Recd.* 1/3/11.)
From the Publishers: Messrs. Methuen & Co.

Senter, *George.* Outlines of physical chemistry. 2nd edition. pp. xvii + 387. ill. London 1911. (*Recd.* 1/3/11.)
From the Publishers: Messrs. Methuen & Co.

II. *By Purchase.*

Castell-Evans, *John.* Physico-chemical tables. Vol. II. Physical and analytical chemistry. pp. xiv + 549 to 1235. London 1911. (*Recd.* 23/2/11.)

Seeligmann, *Franz*, and **Zieke**, *Emil.* Handbuch der Lack- und Firnis-Industrie. pp. xvi + 953. ill. Berlin 1910. (*Recd.* 22/2/11.)

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held on Thursday, March 23rd, 1911, at 5 p.m., when the President will deliver his address, entitled, "On the Initiation and Propagation of Explosions."

ERRATA.

1911. P. 46, alter title of paper No. 52 to:

"The optical properties of compounds containing an asymmetric 'quaternary' carbon atom. Part I. The synthesis of β-phenyl-β-methylvaleric acid and of *as*-methylethylsuccinic acid."

P. 46, line 13 from below, *read* "Compounds containing an asymmetric 'quaternary' carbon atom might be."

At the next Ordinary Scientific Meeting on **Thursday**, March **16th**, 1911, at **8.30** p.m., the following papers will be communicated:

"Apparatus for the maintenance of constant pressures above and below the atmospheric pressure: application to fractional distillation." By J. Wade.

"Influence of water on the boiling point of ethyl alcohol at pressures above and below the atmospheric pressure." By J. Wade and R. W. Merriman.

"The interaction of aromatic disulphides with sulphuric acid." By W. G. Prescott and S. Smiles.

"The absorption spectra of permanganates in certain solvents." By T. R. Merton.

"The action of carbon dioxide in the bleaching process." By S. H. Higgins.

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Issued 30/3/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 384.

Thursday, March 16th, 1911, at 8.30 p.m., Professor Harold B. Dixon, M.A., Ph.D., F.R.S., President, in the Chair.

The President referred to the death of Geheimrath Professor Dr. Jacobus Heinricus van't Hoff (elected an Honorary and Foreign Member of the Society on February 2nd, 1888), who died on March 1st last. He stated that the following telegram had been sent to Frau van't Hoff in the name of the Society:

"The President, Officers, and Council of the Chemical Society deeply mourn the loss of their distinguished Honorary and Foreign Member, Professor Doctor J. H. van't Hoff."

Messrs. Harold J. Page and F. Challenger were formally admitted Fellows of the Society.

Firms

icates were read for the first time in favour of Messrs.:

Ernest Carr Bennison, 4, Sir John's Road, Selly Park, Birmingham.
Richard Charles Bowden, B.Sc., 21, Rokeby Avenue, Redland, Bristol.
Algernon John Elkington, 26, Rye Hill Park, S.E.
Alfred Walker Empson, 174, Dhunumtollah Street, Calcutta.
Idris Larkby Owen, M.Sc., 101, Floyer Road, Small Heath, Birmingham.
Robert Robison, Ph.D., B.Sc., 227, Woodborough Road, Nottingham.

Certificates have been authorised by the Council for presentation to Ballot under Bye-law I(3) in favour of Messrs.:

John Ernest Roux Adendorff, Randfontein, Transvaal.
Atulchandra Datta, M.A., Bag Mozaffar Khan, Agra.
Thomas Grantham Giddy, High Street, Newcastle, N.S.W.

A proposal having been made by some of the old students of Robert Wilhelm Bunsen to send a wreath to place at the foot of his statue in Heidelberg on the occasion of the 100th anniversary of his birth (March 31st), the President stated that the Council had authorised him to sign, on behalf of the Chemical Society, the inscription attached to the wreath.

The PRESIDENT read a letter addressed to the Council by Sir Edward Thorpe, stating that a committee had been formed with the object of raising a fund for the erection of a memorial to Joseph Priestley in his native town of Birstall, Yorkshire.

Subscriptions to the fund should be sent to Mr. W. Bagshaw, at Moorfields, Birkenshaw, Leeds.

Of the following papers, those marked * were read:

*69. "Apparatus for the maintenance of constant pressures above and below the atmospheric pressure. Application to fractional distillation." By John Wade and Richard William Merriman.

For pressures below the atmospheric pressure, air is exhausted continuously from the system by an ordinary water-pump. For pressures above the atmospheric pressure, air or other gas is forced in continuously by an automatic compressor, actuated by falling mercury. The pressure is kept constant by a regulator or compensator consisting of an open syphon manometer, which allows air or other gas to escape from, or enter, the system as soon as the desired excess or diminution of pressure is exceeded.

Various devices were also described in connexion with fractional distillation, more especially for changing the receiver without disturbing the pressure.

DISCUSSION.

The PRESIDENT recalled the simple method used by Professor F. D. Brown twenty-five years ago for distillations under reduced pressure. The apparatus devised by the authors was obviously an instrument of great delicacy. He also congratulated the authors on having devised a convenient apparatus for keeping up a high-pressure supply of gases in which the pressure was automatically regulated. He would have found such an apparatus of great use in his work on the ignition-points of gases at varying pressures.

Dr. **Forster** inquired as to the experience of the authors in connexion with bumping. At the lower pressures referred to by Dr. Wade, bumping would present much inconvenience unless checked by admission of air, and as it was the speaker's experience that under very low pressures liquids distilled without bumping, he was interested to know whether this phenomenon accompanied distillation under pressures much exceeding one atmosphere.

Dr. **Wade** said that he and his colleague had experienced no difficulty with bumping; the liquids so far investigated boiled under pressures above atmospheric with perfect steadiness. The only difficulty encountered under high pressures was the great increase in the amount of air dissolved in the distillate, which escaped with considerable energy on releasing the pressure. He thought that Dr. Forster's suggestion of distilling volatile liquids under increased pressure in order to avoid bumping was eminently practicable.

*70. "The influence of water on the boiling point of ethyl alcohol at pressures above and below the atmospheric pressure." By John Wade and Richard William Merriman.

The ratio of water to alcohol in the binary mixture of minimum boiling point, isolated by Young and Fortey (*Trans.*, 1902, **81**, 1717) by systematic fractional distillation, is increased by raising, and diminished by lowering, the pressure under which the fractionation is effected. At pressures below about 80 mm., corresponding with temperatures below about 25°, ethyl alcohol and water cease to form a binary mixture. Under these conditions, anhydrous alcohol is the most volatile phase present in ordinary spirit, and may be separated from the water to any desired extent by systematic fractional distillation. For the same reason, although alcohol, contrary to general belief, is not appreciably hygroscopic, the percentage of water in moist alcohol is slowly increased by exposing it to air, or even by passing dry air through it.

*71. "The interaction of aromatic disulphides and sulphuric acid." By William George Prescott and Samuel Smiles.

When the solutions of certain disulphides in sulphuric acid are mixed with simple aromatic compounds, sulphurous acid is evolved, and unsymmetrical monosulphides are formed. Reasons were adduced in support of the hypothesis that preliminary fission of the dithio-system is effected by the acid, the sulphoxylic acid and mercaptan being produced:

i. $Ar{\cdot}S{\cdot}S{\cdot}Ar + H_2O \longrightarrow Ar{\cdot}S{\cdot}OH + ArSH$.

The first-named substance then yields the unsymmetrical monosulphide by condensation with the aromatic compound:

ii. $Ar{\cdot}S{\cdot}OH + HAr' = Ar{\cdot}S{\cdot}Ar' + H_2O$,

whilst the mercaptan is oxidised to the disulphide (Stenhouse, *Annalen*, 1869, **149**, 250), which is then available for renewed decomposition. It was further shown that the character of this reaction (i) strongly suggests that it is reversible.

This hypothesis explains and correlates in a simple manner all the known reactions of disulphides and mercaptans in sulphuric acid.

*72. "The absorption spectra of permanganates in certain solvents." By Thomas Ralph Merton.

Measurements have been made of the three least refrangible bands in the absorption spectra of potassium, calcium, barium, and zinc permanganates, in water, acetone, acetic anhydride, acetonitrile, methyl acetate, pyridine, methyl alcohol, ethyl alcohol, and ethylene glycol, except in those cases where the reaction between the salt and the solvent is too rapid for measurements to be made; the positions of the absorption maxima vary in different solvents, although the general character of the absorption remains the same.

DISCUSSION.

Mr. MERTON stated, in reply to a question, that no steps had been taken to secure large crystals of the solid solution, as this was not necessary for the purpose of observing the absorption spectrum.

*73. "The resolution of asymmetrical derivatives of phosphoric acid." By Frederic Stanley Kipping and Frederick Challenger.

This work is a continuation of that published by Luff and Kipping (*Trans.*, 1909, **95**, 1993), and deals with the preparation and resolution of dl-*phenyl-β-naphthyl hydrogen phosphate*,

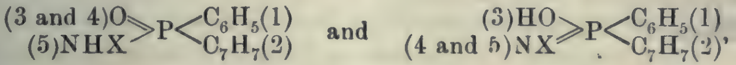
$PO(OPh)(O{\cdot}C_{10}H_7){\cdot}OH$.

Attempts to resolve this acid by the fractional crystallisation of the salts which it forms with optically active bases were unsuccessful, but the l-*menthylamide*, $PO(OPh)(O{\cdot}C_{10}H_7){\cdot}NH{\cdot}C_{10}H_{19}$, was easily separated into its stereochemically isomeric components.

DISCUSSION.

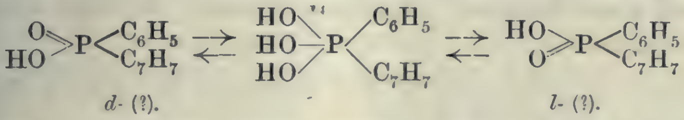
Professor **FRANKLAND** asked what was the order of the difference in rotation of the two isomeric menthylamides. He suggested that the hydrolysis of the menthylamides might probably have been effected if hydrochloric acid instead of potash had been used. He also thought that the resolution of the acid might have been more advantageously attempted by adopting McKenzie's method of partial esterification with menthol or some other optically active alcohol, and that similarly the acid chloride might have been made to interact with an insufficient quantity of an optically active primary or secondary amine.

Dr. **LOWRY** agreed with the authors that the isomeric amides could not be



$$\begin{matrix}(3\text{ and }4)\mathrm{O}\\(5)\mathrm{NHX}\end{matrix}\!\geqslant\!\mathrm{P}\!<\!\begin{matrix}\mathrm{C_6H_5}(1)\\\mathrm{C_7H_7}(2)\end{matrix} \quad\text{and}\quad \begin{matrix}(3)\mathrm{HO}\\(4\text{ and }5)\mathrm{NX}\end{matrix}\!\geqslant\!\mathrm{P}\!<\!\begin{matrix}\mathrm{C_6H_5}(1)\\\mathrm{C_7H_7}(2)\end{matrix},$$

since such compounds would certainly be interconvertible. The production by a reversible action of a mere trace of one of them would, further, be sufficient to bring about the inversion or racemisation of the *d*- and *l*-forms of the other; the double bond of the first compound could be broken in such a way as to produce the OH in position 3 or 4, whilst the breaking of the double bond of the second compound could give rise to NHX in position 4 or 5; the linkings 3, 4, and 5 would, therefore, be interchangeable, and optical activity could not be expected to persist. In the case of the acids, which had resisted all attempts at resolution, it was probably impossible to isolate *d*- and *l*-forms; the addition and removal of water afforded a mechanism for interchanging the



d- (?). *l*- (?).

linkings in ways that would almost certainly result in optical inversion and consequent racemisation.

74. "The action of carbon dioxide in the bleaching process."

By Sydney Herbert Higgins.

On adding calcium chloride to lime-water, the rate of attraction of carbon dioxide from the air by the lime-water is increased, and this fact probably accounts for the observation that the addition of calcium chloride to bleaching powder solution increases the bleaching efficiency of that solution. On exposing bleaching powder solution to air, the free lime contained in the solution is deposited as calcium carbonate, and then the carbon dioxide of the air acts on the other calcium salts present in solution. It is the latter action that causes the exposed bleaching powder solution to have a high bleaching efficiency. Common salt added to sodium hypochlorite solution increases its bleaching activity, and this is also true of other neutral salts of sodium; solutions containing equivalent proportions of these salts have approximately the same effect in increasing the bleaching activity. Moreover, equivalent proportions of common salt and of calcium chloride have approximately the same effect in increasing the activity of bleaching powder solutions. These effects are probably due to the so-called "neutral salt action" and to the increased attraction of the carbon dioxide of the air by the neutral salt solutions. The results of the experiments and other facts (Higgins, *J. Soc. Chem. Ind.*, 1911, **30**, 185) do not agree with the conclusions of Taylor (*Trans.*, 1910, **97**, 2541). The author represents the action of carbon dioxide on bleaching powder by the following equations:

$$(1)\quad Ca(OCl)_2 + CO_2 + H_2O = CaCO_3 + 2HOCl.$$

$$(2)\quad 2HOCl + CaCl_2 + CO_2 = CaCO_3 + 2Cl_2 + H_2O.$$

The action represented by equation (2) is found to be reversible, and thus accounts for Taylor's (*loc. cit.*) and the author's results. In bleaching with bleaching-powder solution, hypochlorous acid enters into the bleaching action, and as much nascent chlorine as is supplied by the reaction represented in equation (2), the carbon dioxide being supplied by the air.

75. "The relation between the absorption spectra of metallic ions and their valency." (Preliminary note.) By Cecil Reginald Crymble.

A study is being made of the absorption of light by aqueous solutions of the salts of metals.

A metallic ion is regarded as being "non-absorptive" when 10 mm. of a normal solution of its salt, or a length of solution containing an equivalent amount of the metal, transmits the spectrum of the iron arc up to λ 2300.

In photographing the absorption spectra, solutions of salts of the metals, such as chlorides or sulphates, have been employed, as in these cases the acidic radicle is non-absorptive, and the absorption, if any, must be due to the metal.

The metals that have been examined up to the present may be grouped into two classes, namely, "non-absorptive" and "absorptive."

The first class, "non-absorptive," contains the following metals:

Li, Na, K, Gl, Mg, Zn, Cd, Ba, Al, Th.

The second class, "absorptive," contains:

Metals giving colourless solutions: Hg, Tl, Sn, Pb, Sb, Bi.

Metals giving coloured solutions: Cu, Ce, Mn, Fe.

In addition to the metals giving coloured ions, the following metals give coloured solutions, and may be included under that head: Au, Cr. U, Co, Pt, Ti, V.

When regarded from the point of view of valency, it will be observed that the first class comprises the metals of constant valency, that is, the metals which are incapable of giving two series of salts, and that the second class comprises the metals of varying valency, that is, those metals which give two or more series of salts—the valency of a metal being determined by the fluorine or chlorine compounds which it forms.

The metals which give absorptive ions may be divided into those showing selective absorption, such as:

Cu, Ce, Cr, Mn, Fe, Co,

and those showing general absorption only, like:

Tl, Sn, Pb, Sb.

The former give two series of salts in which the metal, in passing from the "ous" to the "ic" form, increases its valency by one; for example, iron gives the chlorides $FeCl_2$ and $FeCl_3$.

In the latter group the metal, when changing from the state of low valency to that of high valency, increases its valency by two, for example, tin gives the chlorides $SnCl_2$ and $SnCl_4$.

It has not yet been determined, however, whether this relation is present in all cases.

The research is being continued with a view to observing the difference in absorptive power between the two forms of the same metal where the metal gives two series of salts, and to investigating the absorption spectra of the metalloids and non-metals. An attempt is also being made to trace a relationship between the absorption spectra of the metallic ion and the position of the metal in the electro-potential series.

76. "The element Cu | Cu_2O alkali | H_2 at 0°."

By Arthur John Allmand.

The electrode system $Cu|Cu_2O-N\text{-}NaOH$ was measured at 0°, and by combining with it the calculated value for the electrode $H_2|N\text{-}NaOH$, the value of the *E.M.F.* of the cell $Cu|Cu_2O$ alkali$|H_2$ at 0° was obtained. It is one centivolt higher than the value calculated by Nernst's theorem.

77. "A standard electrode with alkaline electrolyte: Hg | HgO alkali." By Frederick George Donnan and Arthur John Allmand.

The authors have extended previous work carried out with this system, and have been able closely to define three standard electrodes at 25° and 0°, namely:

Hg | HgO *N*-KOH.
Hg | HgO *N*-NaOH.
Hg | HgO *N*/10-NaOH.

The mean errors of the values given vary between ±0·00002 and ±0·00011 volt.

78. "The volatile constituents of coal. Part II." By Maurice John Burgess and Richard Vernon Wheeler.

In continuation of their previous work, the authors have studied the action of heat on coal, paying particular attention to the composition of the gases evolved during successive stages of distillation at a uniform temperature. They find that coal contains two types of compounds of different degrees of ease of decomposition. The one, the more unstable, yields the paraffin hydrocarbons and no hydrogen; the other, decomposed with greater difficulty, yields hydrogen alone (or, possibly, hydrogen and the oxides of carbon) as its gaseous decomposition product. The authors consider that the difference between one coal and another is determined mainly by the proportions in which these two types of compounds exist; and that the true "coal substance," apart from the traces of sulphur compounds and other substances which mask its character, is compounded of the two types that behave so differently under the action of heat. It has been shown that there is considerable justification in assuming that one type of compound in coal, the vegetable origin of which is undoubted, is a degradation product of cellulose. The authors identify the "hydrogen-yielding constituents" with this type, and regard the "paraffin-yielding constituents" as being most probably derived from the resins and gums originally contained in the sap of the coal plants. They suggest that the substance which P. P. Bedson (*J. Soc. Chem. Ind.*, 1908, **27**, 147) has shown to be extracted in considerable quantity from coal by the solvent action of pyridine is compounded of the "paraffin-yielding constituents"; and they therefore regard coal as a conglomerate of which the degradation products of cellulose form the base, and the changed resins and gums of the coal plants the cement.

79. "The absorption spectra of chlorobenzene and bromobenzene as vapours, as liquids, and in solution." By John Edward Purvis.

The chief results of the investigation are: (1) that the vapours of chloro- and bromo-benzene exhibit a considerable number of narrow bands which can be divided into groups; (2) that alcoholic solutions exhibit seven diffuse bands which are comparable in appearance, and only differ in their relative positions; (3) that very thin films exhibit seven diffuse bands which are comparable with each other and with the bands of the solutions, and only differ in their relative positions.

80. "Orthophosphoric acid as a dehydrating catalytic agent. Part I. The condensation of acetone in presence of phosphoric acid." By Pañchānan Neogi.

The author finds that in presence of ortho- and meta-phosphoric acids, acetone condenses to form mesitylene, mesityl oxide, phorone, and xylitone. A given quantity of the acid has repeatedly been used to convert fresh quantities of acetone into its condensation products.

81. "Trialkylammonium nitrites and nitrites of the bases of the pyridine and quinoline series. Part I." By Pañchānan Neogi.

Triethylammonium nitrite and *pyridinium nitrite* have been prepared by the interaction of silver nitrite and the hydrochlorides of the bases. The former exists both in monohydrated and anhydrous conditions, and can be sublimed unchanged under the ordinary, or under diminished, pressure. The latter is anhydrous, and is unstable.

82. "Nitrites of the alkylammonium bases: ethylammonium nitrite, dimethylammonium nitrite, and trimethylammonium nitrite." (Preliminary note.) By Prafulla Chandra Rây and Jitendra Nath Rakshit.

In continuation of their previous work on methylammonium nitrite, the authors have succeeded in preparing the above members of the series by the same method, namely, interaction of silver nitrite and the corresponding chlorides of the alkylammonium bases and evaporation of the filtrate in a vacuum over sulphuric acid. Double decomposition between mercuric nitrite and the free bases in aqueous solution also furnishes the above products. It is worthy of note that whilst methylammonium nitrite is a yellowish-green, crystalline substance, its homologue, *ethylammonium nitrite*, $NH_3Et{\cdot}NO_2$, is a viscid liquid of a pale brownish-yellow colour. *Dimethylammonium nitrite*, $NH_2Me_2{\cdot}NO_2$, is a limpid, pale yellow liquid. *Trimethylammonium nitrite*, $NHMe_3{\cdot}NO_2$, on the other hand, is a pale green, crystalline solid.

83. "Isomeric monothiophosphates."
By William Gidley Emmett and Humphrey Owen Jones.

The isomeric α- and β-methyl monothiophosphates, $PS(OMe)_3$ and $PO(OMe)_2{\cdot}SMe$, have been examined in the hope that on saponification they would yield isomeric sodium monothiophosphates. Two different sodium dimethyl monothiophosphates are formed by the action of sodium methoxide on the esters, and a disodium methyl α-thiophosphate was obtained by saponification of the α-ester with sodium hydrosulphide, but no isomeric trisodium thiophosphates have been isolated.

The interactions of the esters and their derivatives with metallic salts have been examined.

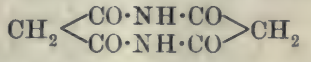
Both α- and β-esters react with methyl iodide to give trimethylsulphonium iodide and a methyl phosphate.

84. "The absorption spectra of chlorobenzene, the dichlorobenzenes, and the chlorotoluenes." By Edward Charles Cyril Baly.

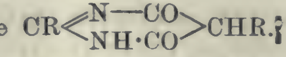
The absorption spectra of chlorobenzene, the three dichlorobenzenes, and the chlorotoluenes have been observed with more efficient apparatus than was possible in the earlier work (*Trans.*, 1905, **87**, 1332, 1355). Some new absorption bands have been detected.

85. "Chemical constitution and hypnotic action. Acid amides and products of the condensation of malonamides and malonic esters." By Frederic George Percy Remfry.

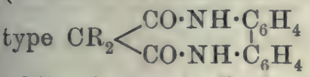
Acid amides are known to possess hypnotic properties to a certain extent. A number of compounds were prepared, in which one hydrogen atom of the amido-group was replaced by various radicles in the hope of increasing the hypnotic power of the acid amide. Such substances as *cinnamoyl*-p-*aminoacetophenone* (m. p. 204—205°), *dicinnamoylcarbamide* (m. p. 246°), and *α-bromoisovaleryl*-p-*aminoacetophenone* (m. p. 113—114°), in which both the acid amide and the substituent, when uncombined, have some narcotic properties, were found to be quite inactive. By condensing ethyl malonate with malonamide, *malonylmalonamide*,



$$\mathrm{CH_2}<\begin{matrix}\mathrm{CO\cdot NH\cdot CO}\\ \mathrm{CO\cdot NH\cdot CO}\end{matrix}>\mathrm{CH_2}$$

(m. p. 252—253°), was obtained. Two alkyl groups can be attached to one of the "quaternary" carbon atoms and one to the other; the product, however, although somewhat resembling diethylbarbituric acid, a very strong hypnotic, was quite inactive. It was found that when a monoalkylmalonamide was condensed with ethyl malonate or ethyl alkylmalonate, a diketotetrahydropyrimidine was formed of the type  $\mathrm{CR}<\begin{matrix}\mathrm{N{-\!-}CO}\\ \mathrm{NH\cdot CO}\end{matrix}>\mathrm{CHR}$. Ethyl monoalkylmalonates, ethyl dimethyl- and methylethyl-malonates (in part) condensed with malonamide to the eight-membered ring as above, but ethyl methylethylmalonate (in part) and the higher dialkylmalonates give a different condensation product with malonamide, the empirical formulæ of which alone have been determined. None of these compounds was physiologically active, nor was *ethylene*bis-5-*propylbarbituric acid*,

$$\mathrm{CO}<\begin{matrix}\mathrm{NH\cdot CO}\\ \mathrm{NH\cdot CO}\end{matrix}>\mathrm{C(C_3H_7)\cdot CH_2\cdot CH_2\cdot C(C_3H_7)}<\begin{matrix}\mathrm{CO\cdot NH}\\ \mathrm{CO\cdot NH}\end{matrix}>\mathrm{CO}$$

(which does not melt at 300°). *Dialkylmalonylbenzidines* of the type  $\mathrm{CR_2}<\begin{matrix}\mathrm{CO\cdot NH\cdot C_6H_4}\\ | \\ \mathrm{CO\cdot NH\cdot C_6H_4}\end{matrix}$ were too insoluble to be of any use, whilst iso*butyl allophanate*, $NH_2\cdot CO\cdot NH\cdot CO_2\cdot CH_2\cdot CHMe_2$ (m. p. 178—179°), and *tert.*-amyl allophanate, $NH_2\cdot CO\cdot NH\cdot CO_2\cdot CEtMe_2$ (m. p. 151—152°), were inactive, the hypnotic properties of the respective alcohols being completely neutralised when combined with allophanic acid.

86. "*p*-Benzoyloxybenzaldehyde."

By Frank George Pope.

The benzoyl derivative of *p*-hydroxybenzaldehyde was prepared in 1893 by Kopp (*Annalen*, **277**, 350) by means of the Schotten-Baumann reaction in 10 per cent. potassium hydroxide solution. The melting point of the compound as obtained in this manner is given as 72°. Since an alkali hydroxide solution of such concentration might possibly affect the course of the reaction, it seemed better to carry out the operation in pyridine solution, and consequently 12 grams of the aldehyde were dissolved in 90 c.c. of pyridine and 14 grams of benzoyl chloride added to the solution. The mixture was well shaken for half an hour, and then poured into 300 c.c. of water, the precipitate collected, well washed, and crystallised from alcohol, when it separated in small, colourless needles, melting sharply at 95°.

As such a considerable difference was found in the melting points, a second preparation was made, using *N*-potassium hydroxide solution. The recrystallised product in this case was also found to melt at 95°, and a mixture of the two specimens melted at 93°. Kopp's specimen thus seems to have been impure, and a few derivatives were therefore prepared in order to characterise the substance. *p*-Benzoyloxybenzaldehyde yielded the following numbers on analysis:

0·1110 gave 0·3026 CO_2 and 0·0480 H_2O. C = 74·35; H = 4·80.
$C_{14}H_{10}O_3$ requires C = 74·34; H = 4·43 per cent.

The *oxime*, prepared in alcoholic solution, crystallised from dilute alcohol in brilliant, colourless needles, melting at 129°:

0·1190 gave 0·3034 CO_2 and 0·050 H_2O. C = 69·51; H = 4·62.
0·1932 „ 10·2 c.c. N_2 (dry) at 22° and 752 mm. N = 5·93.
$C_{14}H_{11}O_3N$ requires C = 69·71; H = 4·57; N = 5·81 per cent.

p-*Benzoyloxybenzonitrile*, $C_6H_5{\cdot}CO{\cdot}O{\cdot}C_6H_4{\cdot}CN$, was obtained by boiling 5 grams of the oxime with 25 grams of acetic anhydride under reflux for two hours. The product was poured, with continual stirring, into 500 c.c. of water, when it set to a solid mass. This was collected, washed, and finally crystallised from dilute alcohol, from which it separates in colourless needles, melting at 95°:

0·1304 gave 0·3610 CO_2 and 0·0476 H_2O. C = 75·70; H = 4·06.
0·2452 „ 13·6 c.c. N_2 (dry) at 18° and 752 mm. N = 6·39.
$C_{14}H_9O_2N$ requires C = 75·34; H = 4·04; N = 6·44 per cent.

p-*Benzoyloxybenzaldehydephenylhydrazone*, prepared in glacial acetic acid solution, crystallises from alcohol, in which it is sparingly soluble, in colourless needles, melting at 178°:

0·1016 gave 0·2830 CO_2 and 0·046 H_2O. C = 75·95; H = 5·03.
0·1038 „ 8 c.c. N_2 (dry) at 18° and 754 mm. N = 8·97.
$C_{20}H_{16}O_2N_2$ requires C = 75·94; H = 5·06; N = 8·86 per cent.

The p-*nitrophenylhydrazone*, obtained in a similar manner, crystallises from hot glacial acetic acid, in which it is sparingly soluble, in small, yellow plates, melting at 208°:

0·1024 gave 0·2490 CO_2 and 0·0378 H_2O. C = 66·32; H = 4·10.
0·1046 „ 10·6 c.c. N_2 (dry) at 18° and 754 mm. N = 11·78.
$C_{20}H_{15}O_4N_3$ requires C = 66·48; H = 4·15; N = 11·63 per cent.

p-*Benzoyloxybenzylidene*-p-*nitroaniline* was prepared by mixing alcoholic solutions of equivalent quantities of *p*-benzoyloxybenzaldehyde and *p*-nitroaniline. After some time a mass of yellow crystals separated, which were collected and recrystallised from xylene; the substance separated as a felted mass of sulphur-yellow needles, melting at 199°:

0·1322 gave 0·3366 CO_2 and 0·0476 H_2O. C = 69·44; H = 4·00.
0·1468 „ 10·4 c.c. N_2 (dry) at 18° and 754 mm. N = 8·24.
$C_{20}H_{14}N_2O_4$ requires C = 69·36; H = 4·05; N = 8·09 per cent.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Ley, *H.* Die Beziehungen zwischen Farbe und Konstitution bei organischen Verbindungen. Unter Berücksichtigung der Untersuchungsmethoden. pp. viii + 246. ill. Leipzig 1911. (*Recd.* 9/3/11.)
From the Publisher: S. Hirzel.

Redgrove, *Herbert Stanley.* Alchemy: ancient and modern. Being a brief account of the alchemistic doctrines, and their relations, to mysticism on the one hand, and to recent discoveries in physical science on the other hand; together with some particulars regarding the lives and teachings of the most noted alchemists. pp. xiv + 141. ill. London 1911. (*Recd.* 3/3/11.)
From the Publishers: Messrs. William Rider and Son.

Roscoe, *Sir Henry Enfield*, and **Harden,** *Arthur.* Inorganic chemistry for advanced students. 2nd edition. pp. viii + 476. ill. London 1910. (*Recd.* 15/3/11.) From Dr. A. Harden.

Wadmore, *John Mello.* Elementary chemical theory. pp. xi + 275. London 1911. (*Recd.* 8/3/11.)
From the Publishers: Messrs. Methuen and Co.

II. *By Purchase.*

Comanducci, *Ezio.* Die Konstitution der Chinaalkaloide. (Sammlung, Vol. XVI.) Stuttgart 1911.

Bemmelen, *J. M. van.* Gedenkbock aangeboden aan J. M. van Bemmelen, 1830–1910. pp. xxix + 461. Helder 1910. (*Recd.* 15/3/11.)

III. *Pamphlets.*

Abegg, *Richard.* Chemische Affinität, Valenz und das natürliche System der Elemente. (From "Scientia," 1910, 8.)

Gray, *George.* On the dissolved matter contained in rain water collected at Lincoln, New Zealand. pp. 12. Christchurch 1910.

Lewis, *Samuel Judd.* Studien über das elementare Zirkonium. pp. 77. Stuttgart 1910.

Metropolitan Water Board, Sixth Report on research work. By *A. C.* **Houston.** pp. 18. London 1910.

Rossitz Experimental Station. Reports on the Austrian coaldust experiments 1908–1909. Abstracted and translated by the *Colliery Guardian* from the *Oesterreichische Zeitschrift für Berg- und Hüttenwesen.* pp. 36. London 1911.

Queensland, Report of the Agricultural Chemist for the year ending 30th June, 1910. pp. 23. Brisbane 1910.

ERRATA.

1910. P. ix (index number), line 6, *for* "March 7th, 1907" *read* "March 7th, 1867."

—— line 1, from below, *for* "July 15th, 1910" *read* "June 15th, 1910."

1911. P. 40, line 17, from below, *for* "chlorine-containing" *read* "halogen containing."

At the next Ordinary Scientific Meeting on **Thursday**, April **6th**, 1911, at **8.30** p.m., the following papers will be communicated:

"The constituents of rhubarb." By F. Tutin and H. W. B. Clewer.

"6-Nitro-3:4:3′:4′-tetramethyldiphenyl." By A. W. Crossley and C. H. Hampshire.

"Diphenylene, a new aromatic hydrocarbon. Part I." By J. J. Dobbie, J. J. Fox, and A. J. H. Gauge.

"The correlation of viscosity with other physical properties. Part I. The ethenoid and ethinoid unsaturation." By T. P. Hilditch and A. E. Dunstan.

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Issued 28/4/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 385

Thursday, March 23rd, 1911, ANNUAL GENERAL MEETING, Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Dr. J. E. MACKENZIE and Dr. R. H. ADERS PLIMMER were appointed Scrutators, and the ballot was opened for the election of Officers and Council for the ensuing year.

The PRESIDENT presented the Report of the Council on the progress of the Society during the past twelve months; and the TREASURER made his statement as to the Society's Income and Expenditure for 1910. After some remarks by Dr. G. McGowan, Mr. A. W. Oke, and Dr. J. A. Voelcker, the Adoption of the Report of the Council, together with the Balance Sheet and Statements of Accounts for the year ended December 31st, 1910, proposed by Mr. DAVID HOWARD and seconded by Dr. F. B. POWER, was carried unanimously.

A Vote of Thanks to the Auditors was proposed by the TREASURER, seconded by Dr. S. SMILES, and acknowledged by Dr. V. H. VELEY.

REPORT OF THE COUNCIL.

Since our last Anniversary Meeting, we, in common with the rest of the Empire, have had to deplore the loss of the gracious

Sovereign whose mission of peace among the nations did so much to foster the steady growth of science. In the address of condolence and of loyalty to his throne which his Majesty King George V. was pleased to receive from the Chemical Society, the Council ventured to call to mind, not only our indebtedness to his late Majesty, but also how much the progress of chemistry in Great Britain was due to the wisdom and foresight of the Prince Consort in the early days of the Society.

The Council is again in a position to report favourably on the progress of the Society, as indicated by an increase in the number of Fellows, and in the list of papers communicated.

On the 31st December, 1909, the number of Fellows was 3,003. During 1910, 165 Fellows have been elected, and 5 were reinstated, the gross total thus being 3,173. The Society has lost 18 Fellows by death; 38 have resigned; the election of 1 Fellow has become void, and 43 Fellows have had their names removed from the list of Fellows for non-payment of annual subscriptions.

The total number of Fellows, therefore, at the 31st December, 1910, was 3,073, showing a net increase of 70 over the preceding year.

The names of the deceased Fellows, with the dates of their election, are:

Richard Abegg (1906).
Robert Barklie (1870).
Robert Haslam Durward Benn, (1904).
Thomas Blackburn (1886).
James Campbell Brown (1867).
Benjamin Samuel Bull (1898).
Michael Carteighe (1864).
John Croysdale (1895).
Frank Barnes Grundy (1903).
Oscar Guttmann (1897).
Edwin Bernard Hadley (1898).
Angus Mackay (1877).
Sir Walter Palmer, Bart. (1879).
Arthur Gaved Phillips (1887).
Richard Wightwick Roberts (1889).
Thomas Bertram Udall (1876).
John Tsawoo White (1889).
Charles Hanson Greville Williams (1862).

The following Fellows have resigned:

John Charles Aylan.
Frederick Nolan Baker.
Frederic Edmund Bowman.
Frank Curzon Britten.
William Burton.
Edward Henry Croghan.
Frank Rawlinson Dudderidge.
Alexander Esilmann.
*William French.
Gilbert Prout Girdwood.
Alfred George Cooper Gwyer.
Frederick John Hambly.
Arthur Lonsdale Hetherington.
Philip Holland.

* Since reinstated.

John Atkinson Jennings.
Harry Lancelot Lee.
Lionel Ludlow.
George Harry Major.
Hubert Fredk. Sankey Marshall.
Leonard Edward Beard Pearse.
Geoffrey Surtees Phillpotts.
William Edmund Francis Powney.
Franklin Ernest Robertson.
Christopher Foulis Roundell.
Edward Cox Seaton.
Leonard Smith.
Alec. Bowring Steven.
Edward Stokes.
Leonard Sumner.
Richard Noel Garrod Thomas.
George Malcolm Thomson.
John Booty Tillott.
William Gaylord Tucker.
James Neill Watts.
James Scott Wilson.
Lewis Thompson Wright.
John William Young.
Thomas Arthur Young.

The names of the Fellows, reinstated by the Council in accordance with Bye-Law IV., are as follows:

Edwin Bayles Atkinson.
Frank Rawlinson Dudderidge.
William French.
Percy Walter Jones.
Charles Frederic Townsend.

The number of Honorary and Foreign Members at the end of 1909 was 33. The Society has to mourn the loss of Professor Stanislao Cannizzaro, Professor Dr. Rudolf Fittig, and Geheim Rath Professor Dr. Hans Landolt, who died during 1910.

It is with great pleasure that the Council offers its congratulations to the following gentlemen, who, during the past year, attained their Jubilee as Fellows of the Society:

Professor Edward Divers, F.R.S.
Mr. Francis Sutton.
Mr. Charles Henry Wood.

During the year 1910, 349 scientific communications have been made to the Society, 273 of which have been published already in the Transactions, and abstracts of all have appeared in the Proceedings.

The volume of Transactions for 1910 contains 2,652 pages, of which 2,601 are occupied by 270 memoirs, the remaining 51 pages being devoted to the Obituary Notices, the Thomsen Memorial Lecture, the Report of the International Committee on Atomic Weights, the Report of the Annual General Meeting, and the Presidential Address; the volume for the preceding year contains 236 memoirs, which occupy 2,133 pages.

The Journal for 1910 contains 4,867 abstracts, which extend to 2,032 pages, whilst the abstracts for 1909 numbered 4,946, and occupied 2,040 pages. The abstracts may be classified as follows:

	Pages.	No. of Abstracts.
PART I.		
Organic Chemistry	908	1,634
PART II.		
General and Physical Chemistry		961
Inorganic Chemistry		494
Mineralogical Chemistry		118
Physiological Chemistry		700
Chemistry of Vegetable Physiology and Agriculture		287
Analytical Chemistry		673
	1,124	3,233
Total in Parts I. and II.	2,032	4,867

During the past year the Society has rejoiced in having the privilege of offering its congratulations and those of the whole chemical world to five of its Past Presidents, who had completed upwards of fifty years' Fellowship of the Society, namely, Prof. W. Odling, the Right Hon. Sir Henry E. Roscoe, Sir William Crookes, Dr. Hugo Müller, and Dr. A. G. Vernon Harcourt. The Banquet held on Friday, November 11th, 1910, to do honour to these gentlemen will remain a notable event in the history of the Chemical Society. To the great regret of all, Sir Henry Roscoe was, owing to indisposition, unable to be present.

In order to render more complete the records and statistics of the Society, and to make them available to the Fellows at large, the Council has ordered the preparation of a complete chronological list of Fellows from the foundation of the Society in 1841.

Professor Theodore W. Richards has been invited to deliver the Faraday Lecture, and the Council has pleasure in announcing that, through the courtesy of the Managers, an extraordinary meeting of the Society will be held on June 14th in the Lecture Theatre of the Royal Institution, where all the Faraday Lectures have been given. The title of the discourse will be announced in due course.

On behalf of the Society, the Council presented a Congratulatory

Address to its Honorary and Foreign Member, Professor Wilhelm Körner, on the occasion of his seventieth birthday.

By the death of Stanislao Cannizzaro, the Society has lost its Senior Honorary and Foreign Member, elected on June 19th, 1862. Sir William Tilden has accepted the invitation of the Council to deliver a Memorial Lecture in his honour.

The Council has further arranged for the following Memorial Lectures to be delivered:

Antoine Henri Becquerel (d. Aug. 25th, 1908). By Professor Ernest Rutherford, F.R.S.

Marcellin Berthelot (d. March 18th, 1907). By Professor Harold B. Dixon, F.R.S.

Henri Moissan (d. Feb. 20th, 1907). By Sir William Ramsay, K.C.B., F.R.S.

In response to an appeal from the University of Toulouse for help in attempting to render good the almost complete destruction of the Science portion of its library by fire on October 27th last, the Council have decided to present the University with a number of volumes of the Transactions of the Chemical Society. It is unfortunately impossible for the Society on such an occasion as this to present a complete set of its publications, owing to the fact that many of the earlier volumes are out of print.

A number of volumes of the Transactions has also been presented to the University of Manitoba, Winnipeg.

In December, 1909, the International Commission for the publication of Physical-Chemical Constants invited the Society to assist in the work of the Commission by contributing towards the expenses of its work. After due consideration, the Council has decided to make a contribution of £10 out of the funds of the Society for the year 1911, at the expiry of which time the matter will receive further consideration.

An intimation has been received from the Secretary of the International Congress of Applied Chemistry that the Congress will meet in the first half of the month of September, 1912, the opening meeting to be held in Washington, and subsequent meetings of the Congress and its Sections in New York City.

Professor A. Haller, on behalf of the Chemical Society of France, has invited the Chemical Society to co-operate in the formation of an International Committee to consider questions of chemical nomenclature and other matters, with a view to facilitate the reading of chemical researches published in different languages Professor Haller suggests that established Chemical Societies should appoint delegates to meet once or twice a year, and that questions

INCOME AND EXPENDITURE ACCOUNT

Income.

				£	s.	d.	£	s.	d.
To Life Compositions ...							219	0	0
,, Admission Fees ...							636	0	0
,, Annual Subscriptions—									
Received in advance, on account of 1910 ...				267	0	0			
,, during 1910 ,, 1910 ...				4183	0	0			
,, ,, ,, ,, 1909 ...				340	0	0			
,, ,, ,, ,, 1905–8 ...				14	0	0			
				4804	0	0			
Less amount included in last year's Income, being valuation of Arrears as per last Balance Sheet ...				356	0	0			
				4448	0	0			
Add Arrears at date: 1910 £468; 1909 £14; 1908 £2, estimated to realise as per Balance Sheet ...				370	0	0			
							4818	0	0
,, Lady Subscribers ...							3	0	0
,, Investments:—									
Dividends on £6730 Metropolitan Consolidated 3½ per cent. Stock ...				221	16	4			
,, £1050 London and North Western Railway 3 per cent. Debenture Stock ...				29	13	2			
,, £1520 14*s*. 8*d*. Cardiff Corporation 3 per cent. Stock ...				42	19	4			
,, £1400 India 2½ per cent. Stock ...				32	19	4			
,, £2400 Bristol Corporation 2½ per cent. Debenture Stock				56	10	0			
,, £4341 Midland Railway 2½ per cent. Preference Stock				102	3	10			
,, £1200 Leeds Corporation 3 per cent. Stock ...				33	18	0			
,, £1500 Transvaal 3 per cent. Guaranteed Stock ...				42	7	6			
,, £1200 North British Railway 3 per cent. Debenture Stock ...				33	18	0			
,, £700 Canada 3½ per cent. Stock 1930/50 ...				11	10	8			
,, Income Tax Recovered ...				30	2	0			
,, Interest on Deposit Account ...				12	6	5			
							650	4	7
Publications:—									
Sales:									
Journals ...				877	15	6			
Proceedings ...				29	1	8			
General Index ...				19	17	4			
Library Catalogue ...				1	1	9			
Atomic Weight Tables ...				1	0	8			
Annual Reports on the Progress of Chemistry ...				140	7	0			
				1069	3	11			
Less Publishers' Commission ...				102	18	9			
				966	5	2			
Proceeds of Advertisements in Journal...	£125	4	1						
Less Commission ...	4	10	3						
				120	13	10			
							1086	19	0
,, Sale of Waste Paper ...							1	0	9
,, Subscriptions from other Societies:—									
Society of Chemical Industry ...				9	9	0			
Society of Public Analysts ...				11	0	6			
Faraday Society ...				2	2	0			
Optical Society ...				8	18	6			
Optical Convention ...				1	11	6			
							33	1	6
,, Balance, being excess of Expenditure over Income, carried to Balance Sheet ...							147	6	4
							£7594	12	2

I have examined the above Accounts with the Books and Vouchers of the Society, and and the Investments

23, Queen Victoria Street,
London, E.C.
13*th March*, 1911.

W. B. KEEN,
Chartered Accountant.

FOR THE YEAR ENDED 31ST DECEMBER, 1910.

Expenditure.

	£	s.	d.	£	s.	d.
By Expenses on account of Journal and Proceedings :—						
Salary of Editor, including Indexing	570	0	0			
Salary of Sub-Editor	200	0	0			
Editorial Postages	24	2	5			
Abstractors' Fees	485	5	10			
Printing of Journal	2879	7	11			
Banding	62	3	2			
Printing of Advertisements	45	1	6			
Wrappers and Addressing	115	10	9			
Distribution of Journal	597	2	8			
Authors' Copies	191	13	0			
Insurance of Stock at Clay's	7	0	0			
				5177	7	3
Printing of Proceedings	223	12	8			
Banding ,, ...	7	8	1			
Distribution ,, ...	35	3	1			
				266	3	10
,, Annual Reports on the Progress of Chemistry				429	10	1
,, Purchase of back numbers of Journal				5	10	3
,, List of Fellows				64	7	8
,, Library Expenses :—						
Salary of Librarian and Assistant...	170	8	0			
Books and Periodicals	244	4	3			
Binding	67	1	7			
				481	13	10
,, Indexing for International Catalogue				30	0	0
,, Balance of Dinner Account				91	15	2
,, Administrative Expenses :—						
Salary of Assistant Secretary	270	0	0			
Salary of Office Assistant...	46	16	8			
Wages (Commissionaire, Housekeeper, and Charwoman)	164	19	5			
Pension, Mrs. Hall	22	10	0			
Coal and Lighting	39	10	7			
House Expenses and Repairs	144	0	4			
Tea Expenses	27	15	1			
Insurances	9	13	10			
Accountants' Charges, 1910	21	0	0			
Commission on Recovery of Income Tax	1	10	1			
Printing	96	11	8			
Stationery	64	8	9			
Illuminated Addresses	5	18	0			
Postages	105	8	1			
Valuation of Furniture	4	4	0			
Miscellaneous Expenses	23	17	6			
				1048	4	1
				£7594	12	2

certify them to be in accordance therewith. I have also verified the Balance at the Bankers

Approved— Victor H. Veley,
Frederick B. Power.
John M. Thomson.

BALANCE SHEET.—THE CHEMICAL SOCIETY, 31ST DECEMBER, 1910.

Liabilities.

	£	s.	d.	£	s.	d.
To Subscriptions received in advance				308	10	0
,, Cash received on Account of Annual Report, Vol. VII. (not published)				30	18	6
,, Sundry Creditors				1589	7	5
,, Research Fund :—						
As per last Balance Sheet	10475	15	4			
Add Excess of Income over Expenditure for the year	29	6	5			
				10505	1	9
				12433	17	8
,, Chemical Society : Excess of Assets over Liabilities :—						
As per last Balance Sheet	20304	16	5			
Less Excess of Expenditure over Income for the year	147	6	4			
				20157	10	1

Assets.

	£	s.	d.	£	s.	d.
By Investments (value when acquired):—						
£6730 Metropolitan Consolidated 3½ per cent. Stock	7212	8	6			
£1050 London and North Western Railway 3 per cent. Debenture Stock	839	12	0			
£1520 14*s.* 3*d.* Cardiff Corporation 3 per cent. Stock	1650	0	0			
£1400 India 2½ per cent. Stock	1316	1	0			
£2400 Bristol Corporation 2½ per cent. Debenture Stock	2070	2	0			
£4341 Midland Railway 2½ per cent. Preference Stock	3572	2	5			
£1200 Leeds Corporation 3 per cent. Stock	1143	1	0			
£1500 Transvaal 3 per cent. Guaranteed Stock	1460	13	6			
£1200 North British Railway 3 per cent. Debenture-Stock	1033	11	0			
£700 Canada 3½ per cent Stock, 1930/50	704	8	6			
				21001	19	11
(Estimated present value of Investments, £18553 16*s.* 3*d.*						
,, Sundry Debtors :—						
Optical Society	8	18	6			
Advertising Accounts	62	15	3			
Messrs. Gurney & Jackson	426	15	5			
Telephone Deposit	1	0	0			
				499	9	2
,, Subscriptions in Arrear, £484. Estimated to realise				370	0	0
,, Insurance paid in advance				66	17	1
,, Cash at Bank on Current Account	136	16	11			
,, Cash in hand	11	2	11			
				147	19	10
,, Research Fund :—						
Investments (value when acquired):						
£1000 North British Railway 4 per cent. No. 1 Preference Stock	1010	0	0			
£4400 Metropolitan Consolidated 3½ per cent. Stock	4587	18	0			
£1034 Great Western Railway 2½ per cent. Debenture Stock	1049	15	11			
£1142 16*s.* New South Wales 3 per cent. Stock	1000	0	0			
£1122 Metropolitan Water Board 3 per cent. "B" Stock	1002	16	9			
£1365 Midland Railway 2½ per cent. Debenture Stock	1010	0	9			
£806 Victoria 3 per cent. Stock	706	6	2			
	10366	17	7			
(Estimated present value of Research Fund Investments, £9769 6*s.* 11*d.*)						
,, Cash at Bank	138	4	2			
				10505	1	9

NOTE.—The estimated value of the Library, exclusive of the Stock of the Society's own publications, is £7200, and of the

RESEARCH FUND INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST DECEMBER, 1910.

Income.

	£	s.	d.	£	s.	d.
To Dividends on :—						
£1000 North British Railway 4 per cent. No. 1 Preference Stock	37	13	4			
£4400 Metropolitan Consolidated 3½ per cent. Stock ...	145	0	4			
£1034 Great Western Railway 2½ per cent. Debenture Stock	24	6	10			
£1142 16s. New South Wales 3 per cent. Stock...	32	5	10			
£1122 Metropolitan Water Board 3 per cent. "B" Stock	31	14	0			
£1365 Midland Railway 2½ per cent. Debenture Stock ...	32	2	8			
£806 Victoria 3 per cent. Stock	22	15	4			
				325	18	4
" Repayment of Research Grants :—						
R. D. Abell	1	16	2			
J. W. Mellor	2	4	9			
E. A. Werner	6	9	4			
J. C. Cain	4	9	6			
F. G. Pope		5	6			
T. S. Price		7	1			
Miss J. Smedley			4			
A. J. Allmand		16	2			
H. W. Bywaters	5	10	4			
W. B. Tuck	2	12	11			
Miss A. Homer		7	0			
N. L. Gebhard	3	6	9			
J. A. Carpenter	17	16	3			
				46	2	1
" Sale of old platinum				7	10	1
" Return of Cost of broken apparatus				3	4	0
" Income Tax Recovered				18	10	6
				£401	5	0

Expenditure.

	£	s.	d.	£	s.	d.
By Grants to—						
H. J. Adlam	6	0	0			
W. C. Ball	5	0	0			
C. O. Bannister ...	10	0	0			
H. T. Clarke	5	0	0			
A. Clayton	5	0	0			
Miss M. E. Dobson	7	0	0			
A. E. Dunstan ...	5	0	0			
A. J. Ewins	5	0	0			
J. A. N. Friend ...	8	0	0			
C. S. Gibson	15	0	0			
C. Gilling	5	0	0			
E. Hope	7	0	0			
T. M. Lowry	7	0	0			
W. H. Mills	15	0	0			
J. R. Partington ...	10	0	0			
W. H. Patterson ...	5	0	0			
J. N. Pring	10	0	0			
R. Robinson	10	0	0			
N. V. Sidgwick ...	10	0	0			
J. L. Simonsen ...	10	0	0			
J. J. Sudborough...	5	0	0			
F. B. Thole	5	0	0			
N. Bland	5	0	0			
O. L. Brady	5	0	0			
Carried forward—	180	0	0			
Brought forward—	180	0	0			
H. Browning, jun.	5	0	0			
A. Clayton	5	0	0			
W. W. Close	5	0	0			
J. B. Cohen	5	0	0			
C. H. Desch	5	0	0			
J. G. M. Dunlop ...	15	0	0			
F. P. Dunn	7	0	0			
A. E. Dunstan ...	7	0	0			
J. Ferns	6	0	0			
W. Godden	5	0	0			
V. J. Harding ...	5	0	0			
W. N. Haworth ...	20	0	0			
A. Holt, jun. ...	8	0	0			
F. Holt	10	0	0			
E. Hope	15	0	0			
W J. Jarrard ...	5	0	0			
F. R. Lankshear ...	10	0	0			
A. Lapworth... ...	10	0	0			
H. R. Le Sueur ...	7	0	0			
S. P. U. Pickering	5	0	0			
W. M. Roberts ...	5	0	0			
S. Smiles	10	0	0			
Miss G. M. Walsh	6	0	0			
A. W. Stewart ...	10	0	0			
				371	0	0
" Commission on Recovery of Income Tax					18	7
" Balance, being Excess of Income over Expenditure carried to Balance Sheet				29	6	5
				£401	5	0

I have examined the above Account with the Books and Vouchers of the Society, and certify it to be in accordance therewith. I have also verified the Balance at the Bankers and the Investments.

W. B. KEEN,
Chartered Accountant.

13th March, 1911.

Approved— VICTOR H. VELEY.
FREDERICK B. POWER.
JOHN M. THOMSON.

considered at such meetings should be referred to and discussed by the several Societies independently, and then finally by the International Committee.

The Council has expressed its willingness to appoint delegates to serve on the International Committee, should such be formed.

The Chemical Society has during the past year received, through the kindness of Professor G. Carey Foster, a copy of Richard Watson's "Pars Mettallurgica Institutium Chemicarum"; the Right Hon. Sir Henry E. Roscoe has presented a unique set of photograph portraits of Chevreul; and Mr. Ernest de la Rue has added to the collection of portraits one of the late Warren de la Rue, who was President of the Society during two periods, 1867–1869 and 1879–1880. Valuable presents of the Society's publications have also been received from Mr. J. McDougall and Dr. E. Cox Seaton.

During the year, 1,918 books were borrowed from the Library, as against 1,548 during 1909; of these, 553 were issued by post, as compared with 347 in the preceding year.

The additions to the Library comprise: 163 books, of which 80 were presented, 431 volumes of periodicals (representing 236 journals), and 141 pamphlets, as against 142 books, 418 volumes of periodicals (representing 243 journals), and 80 pamphlets last year.

Although the income of the Society for the year 1910 falls short of its expenditure by no less than £147 6*s.* 4*d.*, this need hardly cause any serious alarm, nor must it be assumed that henceforth this must be our usual condition. This undesirable result on the year's working has been brought about by several causes acting simultaneously.

The increase in income for 1909 over that for 1908 was £252, whilst that for 1910, from all sources, only exceeded that for 1909 by £59 17*s.* 10*d.*, the respective amounts being £7,447 5*s.* 10*d.* for 1910, and £7,387 8*s.* for 1909. Whilst our income has improved so little, the expenditure has risen from £7,028 3*s.* 5*d.* to £7,594 12*s.* 2*d.*, an increase of £566 8*s.* 9*d.* As mentioned earlier in the report, the volume of our *Transactions* has increased by more than 500 pages, that is, roughly, a quarter more than last year. This is reflected in the increase of £399 7*s.* 5*d.* in the cost of the Journal alone. Administrative expenses have also increased much more than usual, owing to certain expenses which had to be met this year of an abnormal character, and which are not likely to recur for several years. The total increase under this head is £188 4*s.* One other item which calls for remark is the large deficit on the Dinner Account, which has to be met from the funds of the Society. This time it amounts to £91 15*s.* 2*d.*, but it ought to be pointed out that this is unusually high, and is due, in part, to the postponement of the Banquet from May 26th until November 11th, necessitated by the death of King Edward on May 8th. In view of the narrow margin between our income and expenditure it is to be hoped that some satisfactory method of avoiding this drain upon our resources may be devised and adopted in arranging for the next Anniversary Dinner, which, in the ordinary course, should fall in March, 1913.

Since the Officers of the Society have undertaken the management of the advertisements a profit of £75 12*s*. 5*d*. has resulted, whereas last year our net gain from this source was a little under £10.

The snapping of one of the links with the past, which all must regret, has been brought about by the death, in September, of Mrs. Emily Hall. The pension of £30 a year, granted in 1903 to Mrs. Hall on the death of her husband, Mr. Josiah Hall, for twenty-five years the courteous collector for the Society, thus lapses.

The income of the Research Fund exceeds the expenditure by £29 6*s*. 5*d*. This is due chiefly to the balances of grants made in previous years which remained unexpended having been returned by the grantees. These amount to £46 2*s*. 1*d*., and this sum is now available for redistribution. The normal income of the Fund is £344, and a sum of £371 was divided amongst forty-eight applicants in amounts ranging from £5 to £20.

A Vote of Thanks to the Treasurer, Hon. Secretaries, Foreign Secretary, and Council for their services during the past year was proposed by Mr. A. D. HALL, seconded by Mr. J. SPILLER, and acknowledged by Dr. J. J. DOBBIE.

The PRESIDENT then delivered his address, entitled, "On the initiation and propogation of explosions." Sir WILLIAM TILDEN proposed a vote of thanks to the President, coupled with the request that he would allow his Address to be printed in the Transactions; the motion was seconded by Sir WILLIAM RAMSAY, and carried with acclamation, the PRESIDENT making acknowledgment.

The Scrutators then presented their Report, and the PRESIDENT declared that the following had been elected as Officers and Council for the ensuing year:

President: Percy F. Frankland, Ph.D., LL.D., F.R.S.

Vice-Presidents who have filled the Office of President: H. E. Armstrong, Ph.D., LL.D., F.R.S.; A. Crum Brown, D.Sc., LL.D., F.R.S.; Sir William Crookes, O.M., D.Sc., F.R.S.; Sir James Dewar, M.A., LL.D., F.R.S.; H. B. Dixon, M.A., Ph.D., F.R.S.; A. G. Vernon Harcourt, M.A., D.C.L., F.R.S.; R. Meldola, F.R.S.; H. Müller, Ph.D., LL.D., F.R.S.; W. Odling, M.A., M.B., F.R.S.; Sir William Ramsay, K.C.B., LL.D., F.R.S.; J. Emerson Reynolds, Sc.D., M.D., F.R.S.; the Rt. Hon. Sir Henry E. Roscoe, LL.D., F.R.S.; Sir Edward Thorpe, C.B., LL.D., F.R.S.; Sir William A. Tilden, D.Sc., F.R.S.

Vice-Presidents: G. T. Beilby, LL.D., F.R.S.; J. Norman Collie, Ph.D., F.R.S.; M. O. Forster, D.Sc., Ph.D., F.R.S.; A. Liversidge, LL.D., F.R.S.; W. J. Pope, M.A., F.R.S.; J. Walker, D.Sc., Ph.D., F.R.S.

Treasurer: Alexander Scott, M.A., D.Sc., F.R.S.

Secretaries: Arthur W. Crossley, D.Sc., Ph.D., F.R.S.; G. T. Morgan, D.Sc.

Foreign Secretary: Horace T. Brown, LL.D., F.R.S.

Ordinary Members of Council: W. A. Bone, D.Sc., Ph.D., F.R.S.; W. R. Bousfield, M.A., K.C.; Adrian J. Brown, M.Sc.; J. B. Cohen, Ph.D., B.Sc.; C. F. Cross, B.Sc.; C. E. Groves, F.R.S.; A. R. Ling; A. McKenzie, M.A., D.Sc., Ph.D.; Hugh Marshall, D.Sc., F.R.S.; J. C. Philip, M.A., D.Sc., Ph.D.; Sir Boverton Redwood, D.Sc.; A. E. H. Tutton, M.A., D.Sc., F.R.S.

Thursday, April 6th, 1911, Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

The PRESIDENT made the following announcements:

(*a*) That the Council had appointed the following Committees for 1911–1912:

Finance Committee: Messrs. E. G. Hooper, G. T. Moody, Sir Edward Thorpe, Sir William Tilden, and the Officers.

House Committee: Messrs. W. R. Dunstan, R. Messel, J. E. Reynolds, J. M. Thomson, Sir Edward Thorpe, Sir William Tilden, and the Officers.

Library Committee: Messrs. B. Dyer, W. Gowland, A. Harden, J. T. Hewitt, C. A. Keane, A. R. Ling, R. Meldola, E. J. Mills,

J. C. Philip, J. M. Thomson (Chairman), Sir William A. Tilden, J. A. Voelcker, the Editor, and the Officers.

Publication Committee: Messrs. J. N. Collie, B. Dyer, M. O. Forster, C. E. Groves, J. T. Hewitt, A. McKenzie, J. C. Philip, Sir William Ramsay, and the Officers.

Research Fund Committee: Messrs. H. B. Baker, G. T. Beilby, W. R. Bousfield, J. N. Collie, H. B. Dixon, A. Liversidge, R. Meldola, Sir Alexander Pedler, W. J. Pope, J. E. Reynolds, and the Officers.

(*b*) That the Faraday Lecture would be delivered on Wednesday, June 14th, 1911, at 8 p.m., by Professor Theodor W. Richards, in the Lecture Room of the Royal Institution.

(*b*) That Sir William A. Tilden had been appointed by the Council to act as delegate of the Society on the occasion of the Celebration of the 500th Anniversary of the Foundation of St. Andrew's University.

Certificates were read for the first time in favour of Messrs.:

Ernest Andrew Atkins, 71, East Hill, Wandsworth, S.W.
George Arthur Bradshaw, M.Sc., 28, Raymond Street, Bury.
Arthur Frederick Clarke, 12, York Avenue, Gillingham.
Charles Ernest Cooke, 35, Sebert Road, Forest Gate.
Edgar Harold Gardner, 34, Salisbury Avenue, Colchester.
Rowland Lewis Goold, 5, Corporation Street, Birmingham.
Edward Lionel Joseph, 96, Victoria Street, S.W.
Richard William Merriman, M.A., 244, Victoria Park Road, S. Hackney

Of the following papers, those marked * were read:

*87. "The constituents of rhubarb."

By Frank Tutin and Hubert William Bentley Clewer.

The material employed for this investigation consisted of the best quality of sun-dried "Shensi" rhubarb. An alcoholic extract of the drug, when distilled with steam, yielded small amounts of palmitic and chrysophanic acids, together with a hexoic acid and some essential oil.

The portion of the extract which was soluble in water yielded cinnamic and gallic acids, rhein, emodin, aloe-emodin, emodin monomethyl ether, chrysophanic acid, and a new anthraquinone derivative, $C_{17}H_{10}O_6$ (m. p. 295—297°), which it is proposed to designate *rheinolic acid.* It yielded, furthermore, a crystalline mixture of the glucosides of rhein, emodin, aloe-emodin, emodin monomethyl ether, and chrysophanic acid; dextrose; lævulose; tannin; and an amorphous, non-glucosidic resin. This resin, on hydrolysis, gave small amounts of gallic and cinnamic acids, rhein, emodin, aloe-emodin, emodin monomethyl ether, and chrysophanic acid, together with a new *compound*, $C_{14}H_{12}O_3$ (m. p. 256°), which is probably a *trihydroxydihydroanthracene.*

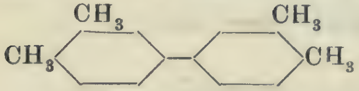
The portion of the extract undissolved by water yielded a trace of a hydrocarbon (m. p. 64°); a phytosterol (verosterol), $C_{27}H_{46}O$; a mixture of fatty acids, consisting of palmitic, stearic, oleic, linolic, and linolenic acids, both free and combined; rhein; rheinolic acid; emodin; aloe-emodin; emodin monomethyl ether; chrysophanic acid; and a trace of a substance which did not fuse at 340°, but yielded an acetyl derivative, melting at 335°. It also gave some amorphous products, and a further quantity of the crystalline mixture of the glucosides of the anthraquinone derivatives.

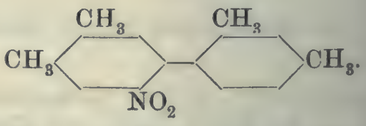
Of the anthraquinone derivatives, only aloe-emodin and chrysophanic acid had any purgative action, the mixture of glucosides being quite inert. The chief purgative principle is the above-mentioned non-glucosidic resin.

*88. "6-Nitro-3 : 4 : 3′ : 4′-tetramethyldiphenyl."

By Arthur William Crossley and Charles Herbert Hampshire.

In continuation of experiments already described (*Proc.*, 1909, **25**, 162), the nitro-group has been eliminated from the nitrotetramethyldiphenyl prepared by the action of nitric acid on *o*-xylene, and the resulting tetramethyldiphenyl has been proved identical with 3 : 4 : 3′ : 4′-tetramethyldiphenyl:





The latter hydrocarbon has been synthesised from 4-iodo-*o*-xylene under the influence of copper powder.

No direct evidence is forthcoming as to the position of the nitro-group, but indirect evidence supports the conclusion that it occupies position 6.

*89. "Diphenylene, a new aromatic hydrocarbon. Part I." By James Johnston Dobbie, John Jacob Fox, and Arthur Josiah Hoffmeister Gauge.

Diphenylene, $C_6H_4{:}C_6H_4$, was prepared by the prolonged action of sodium on 2 : 2′-dibromodiphenyl (melting at 81°) dissolved in dry ether. The yield of the crude material is practically quantitative. This hydrocarbon dissolves readily in the usual organic solvents, and is best crystallised from light petroleum or alcohol; from such solutions it separates in flat prisms, melting at 74·5—75°. It closely resembles diphenyl in appearance and odour, but differs in melting point. When mixed with diphenyl, its melting point is depressed several degrees. Its absorption spectrum shows considerably greater general absorption than that of diphenyl.

The analysis and molecular-weight determinations gave results agreeing with the formula $C_{12}H_8$.

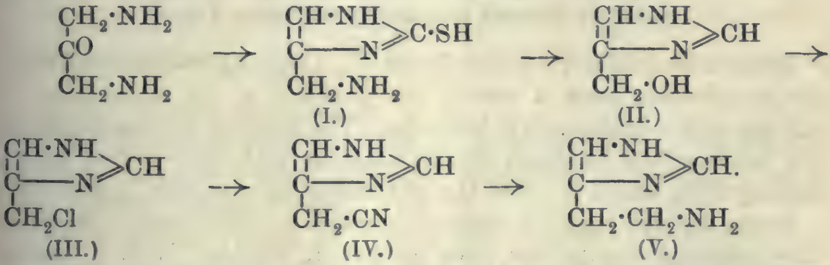
Discussion.

The President pointed out that benzene was usually stated to yield some phthalic acid on oxidation; it was therefore very remarkable that the authors should have found that diphenyl did not. Possibly the benzene used in the experiments on which the statement was based was not really pure.

*90. "A new synthesis of 4(or 5)-β-aminoethylglyoxaline, one of the active principles of ergot." By Frank Lee Pyman.

The following synthesis of 4(or 5-)-β-aminoethylglyoxaline affords a convenient method for its preparation.

Diaminoacetone dihydrochloride when heated with potassium thiocyanate yields 2-*thiol*-4(or 5-)-*aminomethylglyoxaline* (I) [m. p. 188° (corr.)], which on oxidation with nitric acid gives 4(or 5)-*hydroxymethylglyoxaline* (II) [m. p. 93—94° (corr.)]. The hydrochloride of the latter is converted by phosphorus pentachloride into 4(or 5)-*chloromethylglyoxaline hydrochloride* (III) [m. p. 144—145° (corr.)], and this, when suitably treated with potassium cyanide, gives rise to 4(or 5)-*cyanomethylglyoxaline* (IV) [m. p. 138—140° (corr.)]. The latter base, on reduction with sodium and alcohol, yields 4(or 5)-β-aminoethylglyoxaline (V).

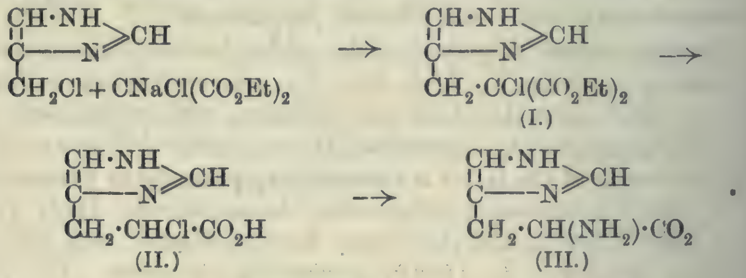


A number of salts of these compounds, and several derivatives obtained as by-products in the various stages of the synthesis, were also described.

*91. "The synthesis of *r*-histidine." (Preliminary note.)

By Frank Lee Pyman.

4(or 5)-Chloromethylglyoxaline hydrochloride, of which the synthetical preparation is described in the preceding communication, is a valuable compound for the synthesis of substances containing the glyoxaline complex, for it reacts readily with ethyl sodioacetoacetate, ethyl sodiomalonate, and similarly constituted compounds, forming the corresponding 4(or 5)-glyoxalinemethyl ($C_3H_3N_2{\cdot}CH_2-$) derivatives. By the use of this salt, the synthesis of *r*-histidine has been effected as follows. 4(or 5)-Chloromethylglyoxaline hydrochloride and ethyl sodiochloromalonate readily condense, yielding *ethyl* 4(or 5)-*glyoxalinemethylchloromalonate* (I), of which the *sesquioxalate*, $(C_{11}H_{15}O_4N_2Cl)_4(C_2H_2O_4)_3$, melts and decomposes at 176° (corr.). This base, on hydrolysis with 20 per cent. hydrochloric acid, gives r-*α-chloro-β-glyoxaline*-4(or 5)-*propionic acid* (II) [m. p. 201° (corr.)], which, when heated with strong ammonia at 110°, yields *r*-histidine (*r*-α-amino-β-glyoxaline-4(or 5)-propionic acid, (III) [melting and decomposing at 283° (corr.)], identical in all respects with that obtained by racemising the naturally-occurring amino-acid *l*-histidine.



*92. "A synthesis of phenanthrene."

By James Kenner and Emily Gertrude Turner.

Jackson and White (*Amer. Chem. J.*, 1880, **2**, 383) showed that dihydrophenanthrene is one of the products of the interaction of sodium with *o*-bromobenzyl bromide. The authors are investigating the intermediate products of this reaction with the view of determining from which of them the phenanthrene synthesis is effected.

From *ωω'*-dibromo-2:2'-ditolyl, a possible intermediate product, dihydrophenanthrene has been prepared, together with a hydrocarbon, melting at 212—213°, the nature of which has not yet been determined. From *ωωω'ω'*-tetrabromo-2:2'-ditolyl a 67 per cent. yield of phenanthrene has been obtained.

ωω′-Dibromo-2:2′-ditolyl, $CH_2Br \cdot C_6H_4 \cdot C_6H_4 \cdot CH_2Br$, rhombic prisms, m. p. 88°, and *ωωω′ω′-tetrabromo-2:2′-ditolyl*,

$$CHBr_2 \cdot C_6H_4 \cdot C_6H_4 \cdot CHBr_2,$$

rhombic prisms, m. p. 138°, are formed by bromination of 2:2′-ditolyl at 110°.

2:2′-*Diphenylenediformaldehyde*, $CHO \cdot C_6H_4 \cdot C_6H_4 \cdot CHO$, thin plates, m. p. 62—63° (*hydrazone*, rectangular plates, m. p. 102° with decomposition), was prepared by the hydrolysis of tetrabromoditolyl in dilute alcoholic solution with potassium oxalate. Preliminary experiments have shown that it undergoes condensation when boiled with potassium cyanide, but the product does not yield phenanthraquinone on oxidation.

From the dibromide, 2:2′-*diphenylenediacetonitrile*,

$$CN \cdot CH_2 \cdot C_6H_4 \cdot C_6H_4 \cdot CH_2 \cdot CN,$$

rectangular plates, m. p. 77°, the *diamide*,

$$NH_2 \cdot CO \cdot CH_2 \cdot C_6H_4 \cdot C_6H_4 \cdot CH_2 \cdot CO \cdot NH_2,$$

m. p. 206°, and the *dicarboxylic acid*,

$$CO_2H \cdot CH_2 \cdot C_6H_4 \cdot C_6H_4 \cdot CH_2 \cdot CO_2H,$$

needles, m. p. 168°, have also been prepared in connexion with these studies on cyclic condensation.

93. "The correlation of viscosity with other physical properties. Part I. The ethenoid and ethinoid unsaturation." By Thomas Percy Hilditch and Albert Ernest Dunstan.

The authors intend in this series of papers to compare the viscosity coefficients of a variety of compounds with their molecular refractivity and dispersive power, molecular volume, magnetic rotatory power, optical activity, and other constitutive properties, with the aim of collating a mass of experimental evidence bearing on the general problem of chemical constitution and physical properties.

They propose to obtain comparable viscosity data in two ways:

(*a*) The quantity $\frac{\eta \times 10^6}{\text{Mol. vol}}$ has been shown to be approximately constant for any given series.

(*b*) The viscosity of solutions of fixed molecular concentration gives a sufficiently exact value for comparative purposes when an appropriate solvent is used.

Seven different series of compounds containing the ethenoid and ethinoid linkings have been studied, and it has been found that, in general, the ethinoid linking produces a greater exaltation in a number of physical properties than the ethenoid. When, however, the unsaturated grouping is conjugated with another nucleus possessing considerable residual affinity ($C_6H_5^-$,CO_2H^-,), then the ethenoid anomaly approaches that of the ethinoid.

94. "Chemical action induced by cathode rays and canal rays."

By Edgar Philip Perman.

The transmutation of copper, thorium, and uranium by means of cathode rays and canal rays has been attempted, and the chemical effect of canal rays on a number of substances has been studied. The following are the chief conclusions:

(*a*) Neither cathode rays nor canal rays produce any transmutation of the elements.

(*b*) Canal rays in air or oxygen have a strong oxidising action.

(*c*) The oxidising action appears to be mostly direct, but is accompanied by a scattering effect.

(*d*) Many substances are decomposed by the action of canal rays independently of the nature of the gas in which the rays are produced.

95. "Compounds of copper benzoate with pyridine and quinoline."

By Oscar Lisle Brady.

While attempting to acetylate a compound contaminated with copper powder, by means of benzoyl chloride and glacial acetic acid in pyridine solution, a quantity of blue, crystalline material was obtained. This was found to contain copper, and on decomposition with alkali hydroxide or acids, pyridine and benzoic acid were formed.

Further experiment showed that the substance may be prepared directly from copper benzoate and pyridine.

Copper benzoate was dissolved in boiling pyridine, and the deep blue liquid allowed to cool. The blue, crystalline material which separated was collected and washed with ether.

Found: $C=58{\cdot}5$; $H=5{\cdot}9$.

$Cu(C_7H_5O_2)_2,2C_5H_5N,2H_2O$ requires $C=57{\cdot}6$; $H=4{\cdot}8$ per cent.

On heating in the steam-oven, the compound lost 20·3 per cent. of its weight, yielding a bright green substance, which contained $C=57{\cdot}4$; $H=4{\cdot}8$; $CuO=19{\cdot}0$.

$Cu(C_7H_5O_2)_2,2C_5H_5N,2H_2O$ loses 19·5 per cent. of its weight to give $Cu(C_7H_5O_2),C_5H_5N,H_2O$, which requires $C=56{\cdot}6$; $H=4{\cdot}2$; $CuO=19{\cdot}6$ per cent.

The loss in weight on heating, and the percentage of carbon and hydrogen being high, whilst the value for copper oxide is low, may be accounted for by the presence of free pyridine, as both compounds have a strong odour of the base.

Similar results were obtained when quinoline was substituted for pyridine, but the blue compound was less stable, washing with ether being enough to remove quinoline with the formation of a green substance.

The blue quinoline compound was found to contain $C = 70{\cdot}5$; $H = 5{\cdot}8$; and the green compound obtained from it by heating in the steam-oven gave $C = 61{\cdot}7$; $H = 4{\cdot}2$; $CuO = 18{\cdot}0$:

$Cu(C_7H_5O_2)_2,4C_9H_7N,2H_2O$ requires $C = 69{\cdot}9$; $H = 4{\cdot}9$ per cent.
$Cu(C_7H_5O_2)_2,C_9H_7N,H_2O$ requires $C = 61{\cdot}4$; $H = 4{\cdot}2$;
$CuO = 17{\cdot}5$ per cent.

96. "Experiments on the synthesis of the terpenes. Part XVIII. Synthesis of Δ^5-*o*-menthenol(8), Δ^6-*o*-menthenol(8), and the corresponding menthadienes." By William Henry Perkin, jun.

The *cis-* and *trans*-1-methyl*cyclo*hexan-6-ol-2-carboxylic acids, which are produced by the reduction of 6-hydroxy-*o*-toluic acid, are converted into the corresponding 6-bromo-derivatives, and the esters of these, when digested with diethylaniline, give rise to a mixture of *ethyl* 1-*methyl*-Δ^5- and 1-*methyl*-Δ^6-cyclo*hexenecarboxylates.*

These are separated by fractional esterification and hydrolysis, and are converted, by means of magnesium methyl iodide, into the corresponding menthenols, from which the corresponding menthadienes are obtained by shaking with cold, 5 per cent. sulphuric acid or by boiling with 6 per cent. oxalic acid.

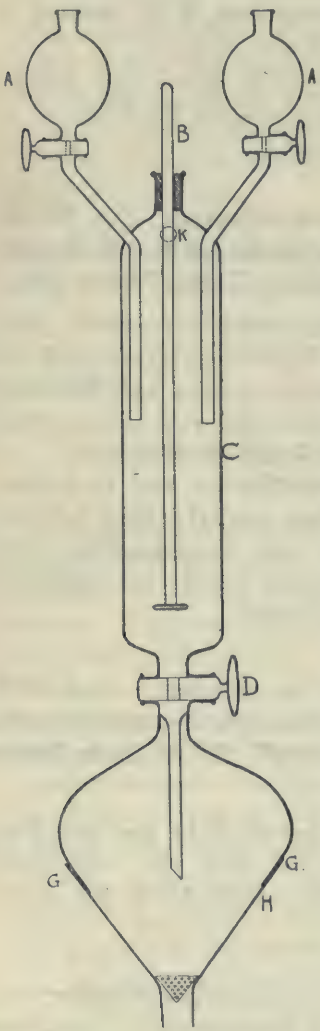
97. "Experiments on the synthesis of the terpenes. Part XIX. Synthesis of *cis-* and *trans*-Δ^3-*o*-menthenol(8), Δ^4-*o*-menthenol(8), and the corresponding menthadienes." By William Henry Perkin, jun.

By the same series of reactions as described in the preceding paper, 4-hydroxy-*o*-toluic acid is converted into cis- and trans-Δ^3-o-*menthenol*(8) and Δ^4-o-*menthenol*(8), which yield the corresponding *menthadienes.*

98. "The condensation of ethyl crotonate and ethyl methylacrylate with ethyl cyanoacetate and ethyl bromoacetate. Synthesis of γ-methylbutane-$\alpha\beta\delta$-tricarboxylic acid and pentane-$\alpha\beta\delta$-tricarboxylic acid." By Edward Hope and William Henry Perkin, jun.

When ethyl crotonate is condensed with ethyl sodiocyanoacetate and the product treated with ethyl bromoacetate, ethyl β-cyano-γ-methylbutane-$\alpha\beta\delta$-tricarboxylate is obtained. On hydrolysis and elimination of carbon dioxide, this yields γ-methylbutane-αβδ-tricarboxylic acid.

By a similar series of reactions pentane-αβδ-tricarboxylic acid is prepared from ethyl methylacrylate and ethyl sodiocyanoacetate. These acids form the starting point for the preparation of *cyclo*pentanonecarboxylic acids.



99. "The volume of a solute in solution. Part II. The influences of molecular association, solvate formation, and ionisation." By Dan Tyrer.

The specific solution volumes of various substances which polymerise in solution have been measured in normal non-associated solvents. It was found that molecular association is quite without influence on the specific solution volume of the solute. Measurements were made also for solutions in which solvates are formed. In these cases it was found that, as a general rule, the specific volume of the solute in solution increased regularly with increase of the concentration. Several exceptions, however, to this rule were observed. In the case of aqueous solution, the conclusion was drawn that hydrates exist in the majority of cases, and with strong electrolytes the evidence points to the existence of hydrated ions.

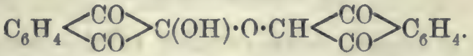
100. "An apparatus for precipitating, filtering, and drying in an inert gas." By James Brierley Firth and James Eckersley Myers.

The apparatus designed for the above purpose is shown in the accompanying sketch.

The reacting liquids are placed in the funnels *A*, *A*, and the remainder of the apparatus is evacuated through a Büchner flask fitted to the filter-funnel *H*. The apparatus is then filled with the inert gas through a side-tube at *K*. The tap *D* being closed, the reacting liquids are run into the precipitating tube *C*, and are mixed by means of the stirrer *B*, which slides in a rubber stopper lubricated with rubber grease. When the reaction is complete, the tap *D*, which has a wide bore, is opened, and the precipitate filtered off in the funnel *H*. The washing and drying are carried out by drawing suitable liquids through the precipitate, and finally aspirating a stream of the inert gas to remove the liquids used for drying. There is a ground glass joint at *G*, by means of which the funnel is prepared for filtration and the precipitate is removed. This apparatus is being used with satisfactory results in the preparation of copper hydride.

101. "Triketohydrindene hydrate. Part III. Its relation to alloxan." By Siegfried Ruhemann.

β-Hydrindone, as well as 1:3-diketohydrindene, may be transformed into triketohydrindene hydrate by Sachs-Barschall's method, but they are less suitable for the preparation of this compound than a-hydrindone (see Ruhemann, *Trans.*, 1910, **97**, 1438). The blue colour reaction which the triketone yields with amino-acids (*Trans.*, 1910, **97**, 2025) was applied to a large number of these substances, and it was found that the triketone is a valuable reagent for proteins and their hydrolytic products. The coloration is accompanied by the production of aldehydes, which points to a similarity between triketohydrindene hydrate and alloxan. This is indicated, also, by the formation of a compound which closely resembles alloxantin, and which is called *hydrindantin*. In accordance with the formula of alloxantin (Piloty and Finckh, *Annalen*, 1904, **333**, 68; Slimmer and Stieglitz, *Amer. Chem. J.*, 1904, **31**, 661), the constitution of hydrindantin is represented thus:



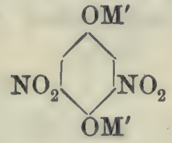
$$\mathrm{C_6H_4}<\begin{matrix}\mathrm{CO}\\ \mathrm{CO}\end{matrix}>\mathrm{C(OH)\cdot O\cdot CH}<\begin{matrix}\mathrm{CO}\\ \mathrm{CO}\end{matrix}>\mathrm{C_6H_4}.$$

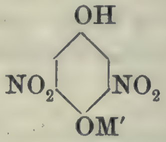
This substance, like alloxantin, is colourless, crystallises with 2 mols. H_2O, and is very sparingly soluble in water; with amino-acids it gives the same coloration as triketohydrindene hydrate. It forms two different sodium salts, according as to whether sodium carbonate or sodium hydroxide is used; one is a dark red salt, and the other is deep blue. With baryta, it yields a blue barium compound, like alloxantin. These salts are decolorised by oxygen. The colourless alkaline solution which is thus formed from hydrindantin contains *o*-carboxymandelic acid. The constitution of these chromo-salts was discussed, and an account was given of the results of the physiological examination of triketohydrindene hydrate.

102. “Salts of 3 : 5-dinitroquinol.” By William Bayliss Shaw.

It has been found possible to obtain a complete series of the alkali metal salts of 3:5-dinitroquinol by adding an alcoholic solution of the metallic hydroxide to an ethereal solution of the free nitro-compound.

The neutral salts (I) are in every case darker in colour than the


(I.)


(II.)

acid salts (II), and the colour deepens progressively from lithium to cæsium as the atomic weights of the metals increase.

The known barium salts have also been investigated, but their properties have not been found to agree with the descriptions given in the literature.

Evidence has been found to support the view that dinitroquinol contains the nitro-groups in the meta-position to one another, and not in the para-position as assumed by Beilstein.

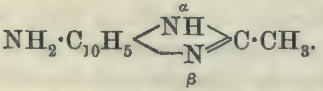
By acting on dinitroquinol with methyl sulphate under suitable conditions the monomethyl ether can be obtained, but the formation of the dimethyl ether by this means does not seem to be possible.

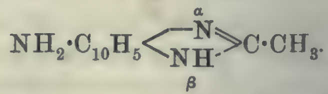
The alkali metal salts of the monomethyl ether have been prepared and investigated.

103. “The question of isomerism between naphthiminazoles.”

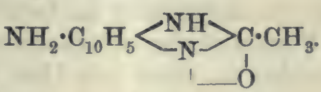
By Raphael Meldola.

In a series of papers communicated to the Society some years ago by the author in collaboration with various students (*Trans.*, 1899, **75**, 1011; 1900, **77**, 1159; 1903, **83**, 1185; 1904, **85**, 1592), a pair of aminonaphthiminazoles and their derivatives were described, which, according to the evidence obtained, were structurally isomeric in the sense indicated by the formulæ:


$\mathrm{NH_2\cdot C_{10}H_5}<\begin{matrix}\overset{\alpha}{\mathrm{NH}}\\ \underset{\beta}{\mathrm{N}}\end{matrix}\gg\mathrm{C\cdot CH_3}.$


$\mathrm{NH_2\cdot C_{10}H_5}<\begin{matrix}\overset{\alpha}{\mathrm{N}}\\ \underset{\beta}{\mathrm{NH}}\end{matrix}\gg\mathrm{C\cdot CH_3}.$

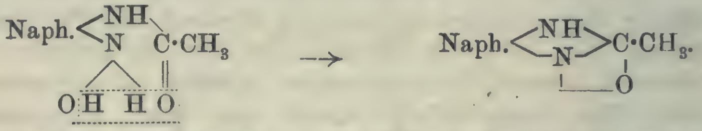
If this isomerism really existed, it would have been opposed to the theory of “virtual tautomerism” applied by Otto Fischer to a somewhat parallel case in the benzene series (*Ber.*, 1901, **34**, 4202; *J. pr. Chem*, 1906, [ii], **73**, 423 *et seq.*). In view of this conflict of evidence, the subject was reinvestigated by this last-named author, who came to the conclusion that one of the supposed isomerides belonged to the series of "oxyiminazoles" first described by St. v. Niementowski (*J. pr. Chem.*, 1907, [ii], **75**, 88). The subject has frequently been referred to since the publication of Fischer's last paper, and has aroused much interest in view of the importance of the theoretical principle involved (see, for example, Pummerer, *Ber.*, 1911, **44**, 343 and 810), and the present author has received several communications inviting an expression of opinion. The facts briefly stated are that dinitro-α-acetonaphthalide when reduced by tin and hydrochloric acid gives a different compound from that which is obtained when the reduction is effected by means of iron and hydrochloric acid (Markfeldt's process). According to Fischer, the base obtained by the first method is an "oxyanhydro-base":



$$NH_2\cdot C_{10}H_5<\begin{array}{c}NH\\N\end{array}>\underset{\underset{O}{|}}{C}\cdot CH_3.$$

The evidence on which Fischer based this conclusion was mainly derived from the observation that the corresponding naphthiminazole on distillation with iron powder gave the known naphthiminazole (ethenyldiaminonaphthalene) of Prager (*Ber.*, 1885, **18**, 2161). It may be pointed out, as Fischer does not refer to this point, that the author had already recorded the transformation of the aminonaphthiminazole prepared by using tin and hydrochloric acid into Markfeldt's base, by the action of iron and hydrochloric acid (Meldola, Eyre, and Lane, *Trans.*, 1903, **83**, 1200).

As it will be some time before the author can undertake to reinvestigate this subject, he desires to place on record the opinion that Fischer's view of the constitution of the compound prepared by using tin and hydrochloric acid is probably correct, although the method of distilling with iron powder must be regarded as a somewhat violent one when the point to be decided is whether the oxygen in a compound is constitutional or whether it is present in the form of attached water. This is, of course, independent of the question of concordant analytical results, which, in the case of these difficultly combustible compounds, are by no means easy to obtain. The attachment of water to anhydro-bases with varying degrees of pertinacity has long been familiar to workers in this field, and it now appears that many of the iminazoles described by the earlier investigators as containing water of constitution and water of crystallisation may really be "oxyiminazoles." St. v. Niementowski is himself continuing the investigation of the latter class of compounds (*Ber.*, 1910, **43**, 3012). The present case is certainly remarkable as an instance of the failure of tin and hydrochloric acid to remove the whole of the oxygen where iron and this acid are effective. The mechanism of this reduction is best explained by the assumption that the hydroxylamine phase is passed through as an intermediate stage:



This possibility was frequently considered during the progress of the research, and several unsuccessful attempts were made to arrest the reduction at an intermediate stage. The dinitro-α-acetonaphthalide is extremely insoluble in the usual organic solvents, and the reduction has therefore to be carried on at a temperature too high to admit of the isolation of an intermediate compound.

While accepting Fischer's view of the constitution of the one series, the author wishes to point out that it seems desirable to obtain further confirmation of the "oxyiminazole" formula, as there is reason for believing that the oxygen in this ring may be easily eliminated in unforeseen ways in the course of the reactions to which these compounds may be submitted (see St. v. Niementowski, *Ber.*, 1910, **43**, 3016). Some of the author's results published in the papers referred to, and which are apparently opposed to the "oxyiminazole" formula, may perhaps be explained from this point of view. The azo-derivatives of both the anhydro-bases give well-defined products on complete reduction; they also give rise to very remarkable compounds when acted on by nitrous acid, and to other and also apparently definite products when decomposed by alkali (Meldola and Eynon, *Trans.*, 1900, **77**, 1167, 1169). The study of these various derivatives may throw further light on the question of the constitution of the parent compounds.

104. "The determination of the density of liquids."
By Harold Hartley and William Henry Barrett.

The precautions necessary in accurate density determinations involving the use of small quantities of liquid were discussed, and a modified form of pyknometer was described.

105. "The influence of temperature on the basic water value of ethyl alcohol." By William Jacob Jones and Arthur Lapworth.

The authors discussed in detail the theory of Goldschmidt and Udby which led them to suppose that the carriers of catalytic activity of acids in water and in alcohol are the cations to which the main part of the conductivity of each solution is due.

Measurements were described showing that the basic water value of anhydrous ethyl alcohol varies from about 0·050 at 0° to 0·097 at 25°, the results being nearly the same, whether obtained by determinations of the effect of water on the catalytic activity or on the salt-forming capacity (availability) of dissolved hydrogen chloride.

The heat of the reaction:

$$C_2H_6O,HCl + H_2O = C_2H_6O + H_2O,HCl,$$

in dilute solution was estimated as, roughly, 1100 gram-calories.

106. "Synthesis and resolution of gnoscopine (*dl*-narcotine)."

By William Henry Perkin, jun., and Robert Robinson.

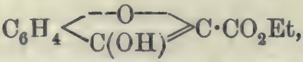
A detailed description was given of the synthesis and resolution of gnoscopine, a preliminary account of which has already appeared (*Proc.*, 1910, **26**, 46, 131).

107. "The occurrence of alizarin in rhubarb." By Hugo Müller.

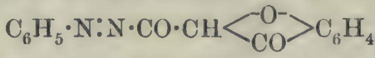
The author has continued his investigations on rhubarb, and finds that the root contains alizarin as well as emodin and chrysophanic acid.

108. "Coumaranone derivatives. Part I."

By Richard William Merriman.

Ethyl coumaranonecarboxylate,  $C_6H_4{<}\begin{matrix}-O-\\ C(OH)\end{matrix}{>}C\cdot CO_2Et$, the "oxygen" analogue of ethyl indoxylcarboxylate, prepared by internal condensation of ethyl salicylylglycollate (Friedländer, *Ber.*, 1899, **32**, 1868), is not hydrolysed by alkalis, as stated by that author, but forms various well-defined metallic derivatives. The *sodium* and *lead* compounds are colourless, the *silver* derivative is yellowish and unstable, and the *ferric* derivative forms very characteristic, deep blue nodules, soluble in alcohol and ether, but insoluble in water, light petroleum, or benzene. In acetic acid solution, however, the ester, under certain ill-defined conditions, forms a yellow *hydrazone* (needles, m. p. 125—126°), which is hydrolysed normally by acids or alkalis.

With alcoholic phenylhydrazine the action, although smooth, is altogether abnormal, the first tangible product being an azo-compound, which is apparently formed by oxidation of the hydrazide. *Benzeneazocarbonylcoumaranone*,



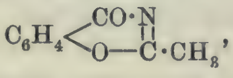
$$C_6H_5\cdot N\colon N\cdot CO\cdot CH{<}\genfrac{}{}{0pt}{}{-O-}{CO}{>}C_6H_4,$$

forms well-defined, orange needles (m. p. 182—183°); it is readily soluble in alkalis, including ammonia, but it is not hydrolysed by them or by acids; the *silver* derivative is a brick-red powder (m. p. 241°, with decomposition). The *hydrazone* of this azo-compound, resulting from the action of excess of phenylhydrazine under the same conditions, forms ruby-red needles (m. p. 193°), and is not acidic.

Ethyl o-*carboxyphenylglycollate*, $CO_2Et\cdot C_6H_4\cdot O\cdot CH_2\cdot CO_2Et$, hitherto known only in an impure state (Rössing, *Ber.*, 1884, **17**, 2995), was readily prepared in quantity for the above work by the direct interaction of ethyl salicylate and ethyl chloroacetate in presence of sodium ethoxide; it is a heavy, colourless oil (b. p. 190—193°/25 mm.). In addition to the yellow diamide described by Rössing, it forms a colourless *monoamide* (needles, m. p. 165°).

109. "The condensation of acetyl chloride and salicylamide."

By Arthur Walsh Titherley and William Longton Hicks.

Acetyl chloride and salicylamide interact immediately in the cold, producing the hydrochlorides of salicylamide and *N*-acetylsalicylamide, the latter evidently by rearrangement of the isomeric *O*-acetyl derivative. By long-continued action of excess of acetyl chloride a white, granular solid is obtained, consisting mainly of a chloro-derivative which with aniline yields *phenylsalicylacetamidine*, $OH\cdot C_6H_4\cdot CO\cdot N\colon CMe\cdot NHPh$. The chloro-derivative gives *N*-acetylsalicylamide immediately on treatment with water, and is probably the impure hydrochloride of the as yet unknown 2-methyl-1 : 3-benzoxazine-4-one,  $C_6H_4{<}\begin{array}{l}CO\cdot N\\ \quad\;\;\|\\ O-C\cdot CH_3\end{array}$, which has resisted all attempts to isolate it.

This unsaturated cyclic compound should, like its phenyl analogue (Titherley, *Trans.*, 1910, **97**, 204), give a phenylsalicylamidine derivative on treatment with aniline.

The mother liquor from the above granular solid contains O-N-*diacetylsalicylamide*, which, however, is best obtained by pyridine acetylation (using acetic anhydride) of *N*-acetylsalicylamide. The diacetyl derivative is remarkable in being readily soluble in cold water, and in undergoing slow, spontaneous hydrolytic decomposition in air, yielding *N*-acetylsalicylamide.

110. "The influence of salts on the autofermentation of yeast." (Preliminary note.) By Arthur Harden and Sydney G. Paine.

It has been found by one of the authors, during an investigation of the permeability of the yeast-cell envelope, that the entrance of such salts as sodium chloride and sodium phosphate is imperceptible when dilute solutions are allowed to act for a short time, and comparatively small even after prolonged immersion of the cells. When, however, more concentrated solutions are employed, an appreciable entrance of the salts is indicated.

These facts, in view of the recent work of H. E. and E. F. Armstrong (*Proc. Roy. Soc.*, 1910, *B*, **82**, 588), therefore suggested the advisability of ascertaining the effect of such salts on the autofermentation of the yeast.

For the experiments here given, top yeast obtained from a London brewery was freed from wort by the simple expedient of pressing, which has been found to give practically quantitative removal of the intersticial liquid; washing was avoided in order that osmotic equilibrium of the cell contents might remain undisturbed.

Three to five grams of such yeast are accurately weighed out for each experiment, wrapped in tissue paper, and dropped into a flask containing a measured quantity of the liquid under investigation, which has previously been saturated with carbon dioxide at 25°. The gas evolved by autofermentation of the yeast is measured periodically by means of the apparatus described by Harden, Thompson, and Young (*Bio.-Chem. J.*, 1910, **5**, 230).

In experiments with sodium chloride and ammonium sulphate it has been found that when these salts are present in decimolar concentration no effect is produced on the autofermentation, but when molar solutions are employed the rate of fermentation is very considerably enhanced during the first four or five hours, so that the volume of carbon dioxide yielded in presence of the salt is three times as great as that given by a water control. At this point, however, the autofermentation in the former case comes abruptly to an end, and eventually after four or five days the volume of gas given in the two cases is approximately the same.

A similar result has also been obtained with a number of other salts, including phosphates, arsenates, acetates, and citrates.

In a recent paper by C. Neuberg and A. Hildesheimer (*Biochem. Zeitsch.*, 1911, **31**, 170) it is stated that salts of pyruvic acid are fermentable by yeast, and that this property is also exhibited by salts of glyceric and lactic acids. Similar experiments have been carried out with these salts, and these have shown that the two latter give precisely the same phenomenon as was found in the case of sodium chloride, whilst with potassium pyruvate the rate of fermentation during the first four hours is exactly comparable with that in a sodium chloride control. At this point, however, the fermentation in presence of the latter salt slackens, while the evolution of gas from the pyruvate solution continues and only gradually diminishes. Eventually after four days some 60 c.c. of carbon dioxide are yielded in presence of 2·4 grams of potassium pyruvate in excess of the volume given by the control.

The provisional conclusion of Neuberg and Hildesheimer that these salts undergo fermentation by yeast cannot, therefore, be accepted until experimental proof is forthcoming that the carbon dioxide is actually derived from them, and not from the constituents of the yeast.

The increase in the rate of autofermentation produced by the addition of salts to living yeast may be explicable on the lines suggested by H. E. and E. F. Armstrong, or it may be that, as a result of plasmolysis of the cells, the glycogen is thrown into more intimate contact with the glycogenase.

The acceleration does not appear to be due to a stimulating influence on the glycogenase, since when added to yeast juice in equivalent concentration sodium chloride tends to inhibit, rather than to enhance, the rate of autofermentation.

111. "Preparation of secondary amines from carboxylic acids. Part II. Preparation of the heptadecyl and pentadecyl derivatives of α- and β-naphthylamine." By Henry Rondel Le Sueur.

The higher alkyl derivatives of both α- and β-naphthylamine are readily obtained by heating the corresponding naphthylamino-acid. Thus, *heptadecyl-α-naphthylamine*, $C_{17}H_{35}\cdot NH\cdot C_{10}H_7$, and carbon dioxide are produced when α-1-*naphthylaminostearic acid*,

$$C_{16}H_{33}\cdot CH(NH\cdot C_{10}H_7)\cdot CO_2H,$$

is rapidly heated above its melting point.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Bingham, *Eugene C.*, and **White**, *George F.* Laboratory manual of inorganic chemistry. pp. viii + 146. New York 1911. (*Recd.* 1/4/11.)
From the Publishers: Messrs. John Wiley and Sons.

International Congress of Applied Chemistry, VII. London, 1909. [Proceedings, etc.] 18 vols. London 1910. (*Reference*).

From the Committee.

Lunge, *George.* The manufacture of sulphuric acid and alkali, with the collateral branches. Vol. III. Ammonia-soda, various processes of alkali making and the chlorine industry. 3rd edition. pp. xix + 764. London 1911. (*Recd.* 21/3/11.) From the Author.

Winterstein, *Ernst,* and **Trier,** *Georg.* Die Alkaloide. pp. vii + 340. Berlin 1910. (*Recd.* 24/3/11.)

II. *By Purchase.*

Carnot, *Adolphe.* Traité d'analyse des substances minérales. Vol. III. pp. 903. Paris 1910. (*Recd.* 23/3/11.)

Desch, *Cecil Henry.* Chemistry and testing of cement. pp. xi + 287. ill. London 1911. (*Recd.* 21/3/11.)

Jörgensen, *Alfred.* Micro-organisms and fermentation. Translated by *Samuel Henry* **Davies.** 4th edition. pp. xi + 489. London 1911. (*Recd.* 21/3/11.)

ERRATA.

1911, p. 57, line 19, *for* "**Part XVI**" *read* "**Part XVII.**"
—— p. 64, ,, 17, ,, "Leeds" *read* "Bradford."

At the next Ordinary Scientific Meeting on **Thursday,** May **4th,** 1911, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"The constituents of bryony root." By F. B. Power and C. W. Moore.

"Note on the action of hydrogen dioxide on thiobenzanilide." By H. Leete and E. de B. Barnett.

"Purification of acetic acid." By K. J. P. Orton, Miss M. G. Edwards, and H. King.

"The detection and estimation of small quantities of acetic anhydride in acetic acid." By Miss M. G. Edwards and K. J. P. Orton.

"Tetramethylammonium hyponitrite and its decomposition by heat." By P. C. Ray and H. K. Sen.

"Reactivity of the halogens in organic compounds. Part VI. The mechanism of negative catalysis." By G. Senter and A. W. Porter.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics.*

The following Candidates have been proposed for election. A ballot will be held on Thursday, May 4th, 1911.

Auld, Samuel James Manson,
65, Margery Park Road, Forest Gate, E.

Research Chemist. D.Sc. (Lond.); Ph.D. (Würzburg); F.I.C. For six years on the staff of the Scientific and Technical Dept. of the Imperial Institute. Recently appointed Lecturer in Chemistry and Head of the Chemical Dept., South Eastern Agricultural College. Author, or joint author, of twenty-five communications to *Journ. Chem. Soc.*, *Journ. Soc. Chem. Ind.*, *Proc. Roy. Soc.*, etc.

Wyndham R. Dunstan. Sam. S. Pickles.
J. T. Hewitt. M. O. Forster.
Arthur W. Crossley.

Bennison, Ernest Carr,
4, Sir John's Road, Selly Park, Birmingham.

Pharmaceutical Chemist. Mem. Inst. Hygiene. Late assistant with Mr. A. Braithwaite, F.I.C., etc., Laboratories, S. Durham Iron Co.; also with Messrs. Brady and Martin, Manufacturing Chemists, Newcastle-on-Tyne. Late Lecturer on Materia Medica and Pharmacy, Middlesbro' Science School and Darlington Technical College. Lecturer Inst. Hygiene, "Radium and Radio-activity," 1909–1910. Admitted to instruction in Radium Institute, Paris, 1908. Lectured on "Radium," Mid. Phar. Assoc., 1910, and "Physiological Action of Formic Acid in Insect Bites," *Ph. J.*, 1907, etc.

J. Archyll Jones. Alfred Southall.
Frederick Doyle. *Gilbert Palmer.*
J. Frederick Alder. *J. W. Patterson.*

Bowden, Richard Charles,

21, Rokeby Avenue, Redland, Bristol.

Science and Mathematic Master. Author of "Studies on the Constitution of Soaps in Solution; Electrical Conductivity of Sodium Stearate Solutions," before Chemical Society, Jan. 19th, 1911 (*Trans. J.C.S.*, February, 1911). B.Sc. (Honours in Chemistry), University of Bristol. Assoc. M.V.T.C., Bristol.

J. Wertheimer. Francis Francis.
F. W. Rixon. *Herbert J. Taylor.*
Robert Gawler.

Bowyer, Arthur Stewart,

The Woodlands, Chelford, Cheshire.

Analytical Chemist, Messrs. Chas. Lowe & Co., Manufacturers of Pure Phenol, etc. Three years student in the Chemical Laboratories, University of Manchester; one year research student. B.Sc. Hons. in Chemistry; M.Sc.

Harold B. Dixon. E. C. Edgar.
W. H. Perkin. Ch. Weizmann.
A. Lapworth. R. Robinson.
Alfred Holt.

Collington, John Eric,

Claremont, Noel Road, Edgbaston.

Analytical Chemist. Have held the position of Chief Assistant in the Laboratory of the Public Analyst for the County Borough of Smethwick for two years.

Arthur Adams. H. S. Shorthouse.
Harry Silvester. William Duncan.
W. Waters Butler.

Crook, Clement Arthur,

4, Dry Clough Lane, Halifax.

Foreman Dyer and Lecturer in Cotton, Wool, and Silk Dyeing. Honours Certificates in Cotton, Wool, and Silk Dyeing (City and Guilds). Lecturer, as above, at Halifax Technical College. Foreman Dyer in yarn and slubbing dyehouse.

E. W. Smith. R. Lyon.
Wm. Cranfield. *T. Luxton.*
J. Wilkinson.

Crymble, Cecil Reginald,

7, Upper Crescent, Belfast.

Chemist. B.Sc. (R.U.I.). Assistant in Chemical Department, Queen's University, Belfast, until 1910. 1851 Exhibition Research Scholar. Publications: "Studien über Absorptions Spektren, Parts I.—III.," with Dr. Stewart and R. Wright.

E. A. Letts.	John Hawthorne.
Robert F. Blake.	A. W. Stewart.

Samuel Smiles.

Dickinson, William Henry,

Bombay.

Captain, Indian Medical Service. Chemical Analyser to Government, Bombay, and Professor of Chemistry, Grant Medical College, Bombay. M.B., Ch.B. (Edin.). F.I.C.

H. Droop Richmond.	Patrick H. Kirkaldy.
John M. Thomson.	Herbert Jackson.

Cecil H. Cribb.

Douse, Oliver Statham,

Fern Bank, Glossop.

Research Student in Chemistry. Four years in the Chemical Laboratories of the Manchester University. B.Sc. with Honours in Chemistry. Assistant in Research Laboratory.

Harold B. Dixon.	E. C. Edgar.
W. H. Perkin.	Ch. Weizmann.
A. Lapworth.	R. Robinson.

Alfred Holt.

Eggington, Alfred Thomas,

The Hawthorns, Ibstock, near Leicester.

Student at Royal College of Science, South Kensington. About to take post as Science Master, Borlase School, Great Marlow. National Scholarship in Chemistry, 1907, and, subsequently, four years at Royal College of Science, South Kensington. Associate of Royal College of Science in Chemistry, 1910, London. B.Sc., 1910, with Third Class Honours in Chemistry. Post-graduate work—chiefly inorganic analytical chemistry.

T. E. Thorpe.	James C. Philip.
M. O. Forster.	G. T. Morgan.

Chapman Jones.

Eldridge, Arthur Alfred,

School House, Alpha Road, Surbiton Hill.

Student. Associate of King's College, London, in the Faculty of Science. Bachelor of Science (London), with Third Class Honours in Chemistry. For four years student at King's College, London. At present Government Student at the Royal College of Science (Imperial College of Science and Technology). Formerly Student Demonstrator in Chemistry at King's College.

John M. Thomson.
Herbert Jackson.
Patrick H. Kirkaldy.
T. E. Thorpe.
M. O. Forster.
G. T. Morgan.

Elkington, John Algernon,
26, Rye Hill Park, S.E.

Analytical Chemist, Government Laboratory. Late Student at Royal College of Science. Passed all examinations in the full chemical course at that College (Organic and Inorganic). Passed entrance examination to Government Laboratory in Chemistry (Organic and Inorganic), Physics and Mathematics (taking first place). Since 1906 employed in Chemical Analytical work at the Government Laboratory.

M. O. Forster.
James C. Philip.
G. T. Morgan.
Chapman Jones.
W. Godden.

Empson, Alfred Walker, A.M.I.E.E., A.M.I.Mech.E.,
Calcutta, India.

General Manager of the Cast Iron Brazing Syndicate, 174, Dhunumtollah Street, Calcutta. For some time a pupil of Mr. A. E. Bell, F.I.C., F.C.S. Have specialised in water and boiler scale analysis, upon which subjects I have contributed several articles to the technical press. Am carrying out all the analytical work in connexion with some borings now being made in Assam for oil. My reason for wishing to join the Society is that I want to keep in touch with the latest developments in Chemical Science.

Albert E. Bell.
Joseph H. Williams.
Frank H. Wall.
H. Sampson Wills.
T. W. Firth Clark.

Enfield, Ralph Roscoe, B.A.,
Toynbee Hall, Commercial Street, E.

Chemist at Tar and Liquor Works, Gas Light & Coke Co., Beckton. Late Scholar and Dixon Research Scholar of Christ Church, Oxford, and Assistant Demonstrator at the University Laboratories, Cambridge. Author of "The Reduction of Chloric Acid," *J.C.S.*, Trans., 1910.

Henry E. Roscoe.
William J. Pope.
H. J. H. Fenton.
H. B. Baker.
T. Wilton.

Harwood, Henry Francis,

Erlesdene, Park Road, Hale, Cheshire.

Demonstrator of Chemistry at the Royal College of Science; M.Sc. of Manchester University; Ph.D. of Heidelberg University. Author of "Die Analyse von Vanadinverbindungen mittels Tetrachlorkohlenstoff."

Harold B. Dixon.
W. H. Perkin.
A. Lapworth.
E. C. Edgar.
Ch. Weizmann.
R. Robinson.
Alfred Holt.

Hughes, Edwin Burnhope,

5, Perham Road, West Kensington, W.

Tutor in Chemistry and Physics at The General Engineering College, Earl's Court, S.W. Six years' experience in teaching Chemistry; educated at Rutherford College, Newcastle-on-Tyne. Reading for Final B.Sc. next October; at present Inter.B.Sc. (1907). Intend to devote myself to Physical Chemistry, and to conduct research, for which I have plans, after Final B.Sc. I wish to enter the Chemical Society in order to keep in touch with advances of Chemistry, etc., and for use of library.

E. Frankland Armstrong.
J. Vargas Eyre.
W. Robertson.
John Gibson.
Edward Horton.
Fredk. P. Worley.

Lucas, Thomas Riley,

No. 3 Cantonments, Vizianagram, Madras (Pres.), India.

Manager and Chemist for Bobbili Mining Co., Ltd., Vizianagram. Associate of City and Guilds Institute. Chemist to Allen's Public Laboratory, Sheffield. Works Chemist, Associated Portland Cement Manufacturers, Gravesend and Grays. Chemist to Bobbili Mining Co., Ltd.

Henry E. Armstrong.
Gerald T. Moody.
W. Robertson.
E. Horton.
T. M. Lowry.
J. V. Eyre.

Messervy, Roney Forshaw,

73, Blenheim Crescent, W.

Chemist. Continuously engaged for the past two years in Technical and Chemical Research Work in the laboratory of Mr. L. A. Levy, M.A., B.Sc., A.I.C., F.C.S. Other reasons: (i) I desire to have the use of the Library. (ii) To receive the Society's publications.

Leonard A. Levy.
W. H. Gibson.
Alfred C. G. Egerton.
H. J. H. Fenton.
H. O. Jones.
F. E. E. Lamplough.
F. W. Dootson.
F. W. Toms.

Moullin, Oswald Mansell-,

69, Wimpole Street, London, W.

B.A., King's College, Cambridge. Science Master at Dover College.

William Ramsay.
Charles T. Heycock.
Alfred Lloyd.
J. K. H. Inglis.
H. O. Jones.

Newton, Leonard Owen,

St. Elba, Napoleon Rd., St. Margarets-on-Thames.

Analytical Chemist. Educ. "Tiffins," Kingston. Pass Cert.: Cambridge Local, Theoretical and Practical Chemistry, etc.; 3 years student at Sir John Cass Technical Institute, Theoretical and Practical Inorganic and Physical Chemistry; 6 years Asst. Manager and Analyst to The "Locomobile" Co., London; at present Analyst to Messrs. Lassen and Hjort, Water Purification Specialists, 52, Queen Victoria St., London., with whom I have been for 5 years.

Charles A. Keane.
H. Burrows.
C. F. Townsend.
Thos. Macara.
Henry Bailey.

Owen, Idris Larkby,

101, Floyer Road, Small Heath, Birmingham.

Senior Science Master, Council Secondary School, Waverley Rd., Birmingham. 1900–1903, Science Master, Technical Institute, King's Lynn. 1903, Responsible for teaching of Chemistry in above School. 1905, M.Sc. (Chemistry), Liverpool University. Student Liverpool University 3 years. Technical School, Birmingham, 3 years.

T. Slater Price.
Douglas F. Twiss.
A. W. Titherley.
Charles A. Keane.
Hamilton McCombie.
Thos. J. Murray.
C. K. Tinkler.
Edgar P. Hedley.
J. E. Coates.

Pastfield, John Lawrence Robinson, B.A., Oxon.,
"Olivedale," St. Thomas, Exeter.

Student. Second Class Honours, Chemistry, Oxford, 1910.

Andrea Angel. F. D. Chattaway.
H. B. Baker. John Watts.
J. E. Marsh.

Penney, Richard Garnet,
40, Duesbery Street, Hull.

Analytical Assistant. Since September, 1902, to the present time, Assistant to Mr. M. D. Penney, Analyst, 11, High St., Hull.

M. D. Penney. Harry Thompson.
F. W. Richardson. *T. L. Patterson.*
Arnold R. Tankard.

Percival, George Arncliffe,
34, Cartwright Gardens, London, W.C.

Metallurgical Chemist, Birmingham Technical School. Metallurgist at Kynoch's; Assistant Analyst to Mr. A. E. Tucker, F.I.C.; now works chemist, Cowper-Coles Engineering Co., Ltd.; particularly interested in rare earths and extraction.

Lionel M. Jones. *T. Slater Price.*
Hamilton Wingate. *J. S. S. Brame.*
Leonard A. Levy. *Charles A. Keane.*

Rivett, Albert Cherbury David,
Chemistry Department, University, Melbourne, Australia.

Assistant Lecturer and Demonstrator. B.A. (Oxon.), B.Sc. (Melb.). Has studied in Melbourne, Oxford, and Stockholm. Has published in the Society's Transactions.

Orme Masson. Harold Hartley.
James Walker. N. V. Sidgwick.
Svante Arrhenius. William Odling.

Robison, Robert,
227, Woodborough Road, Nottingham.

Lecturer and Demonstrator in Chemistry at University College, Nottingham. Ph.D. (Leipzig), B.Sc. (London), F.I.C. Formerly Assistant Lecturer and Demonstrator in Chemistry at University College, Galway. Author of "Über die polychromen Salze aus Dimethyl- und Diphenyl-Violursäure" (Leipzig, 1909); also, conjointly with Prof. Kipping, "Organic Derivatives of Silicon," *J.C.S.*, **93**, 439, and, conjointly with Prof. Hantzsch, "Über die pantochromen Dimethyl- und Diphenyl-violurate," *Ber.*, **43**, 45; "Notiz über Purpursäure," *Ber.*, **43**, 92.

F. Stanley Kipping. Henry J. S. Sand.
R. M. Caven. J. Lister.
Oliver Quibell.

Walker, Eric Everard,

210, Bedford Hill, Balham.

Student. Advanced Student of Chemistry, City and Guilds of London Central Technical College.

Henry E. Armstrong. J. Vargas Eyre.
W. Robertson. T. Martin Lowry.
Edward Horton.

Watson, Henry Hough,

Braystones, *viâ* Carnforth.

Assistant to Mr. W. H. Watson, F.C.S., F.G.S., Analytical Chemist. Chemical research, especially in connexion with agriculture and bacteriology.

William Thomson. *James Porter Shenton.*
Robert Hellon. *J. Carter Bell.*
George Dixon. *C. Estcourt.*
C. H. H. Walker. *Alex. K. Miller.*
W. H. Watson. *Chas. Turner.*

Wilks, William Arthur Reginald,

50, Stowheath Lane, Priestfield, Wolverhampton.

Assistant Demonstrator in Chemistry. M.A. and Fellow of Gonville and Caius College. Published (with Dr. Fenton): "Isoiminazolone" (*J.C.S.*, Trans., 1909, 1329).

W. J. Sell. W. J. Pope.
C. S. Gibson. F. W. Dootson.
H. J. H. Fenton.

Wood, William,

"Katoomba," King Edward Avenue, Dartford.

Pharmaceutical Chemist on staff of the Wellcome Chemical Works, Dartford, for fourteen years. Major qualification of Pharmaceutical Society of Great Britain. Student in the school of the Pharmaceutical Society, 1887–8.

Wyndham R. Dunstan. Francis H. Carr.
H. A. D. Jowett. John Attfield.
E. F. Harrison.

Wright, Robert,

Lauriston, Derrysolgie Avenue, Belfast.

Assistant in Chemistry, Queen's University, Belfast. Graduate (M.A.) of R.U.I. Assistant in Queen's University, Belfast, since 1909. Publications: "Studien über Absorptions Spektren, I.—III.," with Dr. Stewart and C. R. Crymble.

E. A. Letts.	John Hawthorne.
Robert F. Blake.	A. W. Stewart.

Samuel Smiles.

The following Certificates have been authorised by the Council for presentation to Ballot, under Bye-law I. (3):

Adendorff, John Ernest Roux,

Randfontein, Transvaal.

Analytical Chemist, Assayer, and Metallurgist. Studied Chemistry, theoretical and practical, for three years (1900–1903) under Dr. P. D. Hahn, Ph.D., M.A., of the S. African College, Cape Town. Served two years as Chemical Assistant in the Government Laboratories, Cape Town (1903–1905). Was Chief Assayer for ten months to Randfontein South Gold Mining Co. (1907–1908). Am Chief Chemist to the Robinson Group of Companies, Witwatersrand, Transvaal (1908). (1) Have investigated into cause of formation of "white precipitate" in zinc precipitation boxes from gold bearing solutions. (2) Experimented as to rate of solubility by aëration in "Pachnea" tanks of the gold in the Rand ore, using weak cyanide solution.

J. Müller.	John G. Rose.
E. V. Flack.	J. McCrae.

Datta, Atulchandra, M.A.,

Bag Mozaffar Khan, Agra.

Senior Professor of Science, St. John's College, Agra. Took the M.A. Degree of the Calcutta University in Physical Science in 1892, and serving as a Professor of Physics and Chemistry for about fifteen years. Written the following books: (1) "Aids to the study of Science for B.A. Students"; (2) "University Papers on Chemistry;" (3) "Lecture Notes on Inorganic Chemistry;" (4) In the press: "Wave Motion and Sound, for the B.Sc. Students." Desires admission to keep in touch with recent chemical investigations, etc., etc.

Tarak Nath Das.	*Ram Chandra Mukerjee.*
Bidhu Bhusan Dutta	*Gopal C Banerjee.*

T. K. Buxy.

Giddy, Thomas Grantham,

High Street, Newcastle, New South Wales, Australia.

Science Master. Associate of Sydney Technical College in Metallurgy and Assaying (which included full courses in Theoretical and Analytical Chemistry). For several years Honorary Assistant Science Master at Newcastle (N.S.W.) Technical College. Formerly acted as Science Master at Newcastle and East Maitland High Schools, as Lecturer in Chemistry at Maitland Technical College, and at present as Science Master at Newcastle Technical College and School of Mines, lecturing in Chemistry (Theoretical and Analytical) and Assaying.

Albert J. Sach. Henry G. Smith.

Wheldon, Alfred Henry Finniss-,

446, Currie Road, Durban, Natal, South Africa.

Student [completing Course of Chemistry and Chemical Technology with the International Correspondence Schools, Ltd. (London)]. I wish to keep in touch with the science of Chemistry, in which I am very much interested. I have a private laboratory to enable me to undertake analytical work.

W. T. A. Edwards. *James A. H. Armstrong.*
L. Ernest Rouillard. *Hamilton Wingate.*

R. CLAY AND SONS. LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 15/5/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 386.

Thursday, May 4th, 1911, at 8.30 p.m., Professor Percy F. Frankland, LL.D., F.R.S., President, in the Chair.

Messrs. J. Bate and R. Hurst were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Arthur Owen Blackhurst, Downing, Broughton, Preston.
Ganesh Datta, B.A., Dera Ismail Khan, N.W.F.P., India.
Joges Chandra Ghose, M.A., Bhagalpur, Behar, India.
Herbert James Ling, Hankow, China.
Felix Gabriel Paul, No. 64, 38th Street, Rangoon, Burma.
William Keighley Walton, Beechwood, Upper Rushton Road, Thornbury, Bradford.

The President announced that a general discussion on the subject of "High Temperatures" would take place at a meeting of the Faraday Society to be held on Tuesday, May 23rd, 1911.

A ballot for the election of Fellows was held, and the following were subsequently declared duly elected:

John Ernest Roux Adendorff.
Samuel James Manson Auld, D.Sc., Ph.D.
Ernest Carr Bennison.
Richard Charles Bowden, B.Sc.
Arthur Stewart Bowyer, M.Sc.
John Eric Collington.
Clement Arthur Crook.
Cecil Reginald Crymble, B.Sc.

Atulchandra Datta, M.A.
William Henry Dickinson, M.B., Ch.B.
Oliver Statham Douse, B.Sc.
Alfred Thomas Eggington, B.Sc.
Arthur Alfred Eldridge, B.Sc.
Algernon John Elkington.
Alfred Walker Empson.
Ralph Roscoe Enfield, B.A.
Thomas Grantham Giddy.
Henry Francis Harwood, M.Sc., Ph.D.
Edwin Burnhope Hughes.
Thomas Riley Lucas.
Roney Forshaw Messervy.
Oswald Mansell-Moullin, B.A.
Leonard Owen Newton.
Idris Larkby Owen, M.Sc.
John Lawrence Robinson Pastfield, B.A.
Richard Garnet Penny.
George Arncliffe Percival.
Albert Cherbury David Rivett, B.A., B.Sc.
Robert Robison, Ph.D., B.Sc.
Eric Everard Walker.
Henry Hough Watson.
Alfred Henry Finniss-Wheldon.
William Arthur Reginald Wilks, M.A.
William Wood.
Robert Wright, M.A.

Of the following papers, those marked * were read:

*112. "The constituents of bryony root."

By Frederick Belding Power and Charles Watson Moore.

The material employed for this investigation consisted of the freshly collected roots of *Bryonia dioica*, Linné.

The roots were found to contain an enzyme, which was obtained in the form of a light brown powder. This product slowly hydrolysed the glucosidic constituent of the root, and also effected the hydrolysis of amygdalin and salicin.

An alcoholic extract of the root, when distilled in steam, yielded a small amount of a pale yellow essential oil. From the portion of the extract which was soluble in water, and contained a quantity of sugar, there were isolated: (i) a colourless, neutral *substance* (m. p. 220—222°), which appears to possess the formula $C_{20}H_{30}O_5$, and has $[\alpha]_D + 58{\cdot}6°$; (ii) an amorphous glucosidic product, having a bitter taste, which, on hydrolysis, yielded a brown resin and a sugar, from which *d*-phenylglucosazone (m. p. 208—210°) was prepared; (iii) an amorphous alkaloidal principle, possessing an intensely bitter taste, which was apparently incapable of forming any crystalline salt.

The portion of extract which was insoluble in water consisted of a dark brown, viscid resin, amounting to about 2 per cent. of the weight of dried root employed. From this material the following compounds were isolated: (i) a phytosterol, $C_{27}H_{46}O$ (m. p. 137°), which was optically inactive; (ii) a new dihydric alcohol, *bryonol*, $C_{22}H_{34}O_2(OH)_2$, melting at 210—212°, and yielding a *diacetyl* derivative, melting at 152°. Bryonol belongs to a group of dihydric alcohols possessing the general formula $C_nH_{2n-3}O_4$, which comprises the following additional compounds: ipurganol, $C_{21}H_{32}O_2(OH)_2$;

grindelol, $C_{23}H_{36}O_2(OH)_2$; and cucurbitol, $C_{24}H_{38}O_2(OH)_2$; (iii) oleic, linolic, palmitic, and stearic acids.

The activity of the root appears to reside chiefly in its resinous and alkaloidal constituents, and the so-called "bryonin" of previous investigators has been shown to consist of a complex mixture, which was not entirely glucosidic.

*113. "Reactivity of the halogens in organic compounds. Part VI. The mechanism of negative catalysis." By George Senter and Alfred William Porter.

The kinetics of the reaction of silver nitrate with bromoacetic and α-bromopropionic acids respectively in absolute ethyl alcohol have been measured at 49·9°. The reactions are retarded by nitric acid to an even greater extent than in aqueous solution. A formula which represents the results fairly satisfactorily was given.

A formula which represents accurately the decomposition of α-bromopropionic acid by water has been derived on the assumption that both the anions and the non-ionised acid react with water.

It was shown that the usual formula which represents negative catalysis as a difference between two factors is not in accord with the available experimental data. An empirical formula, based on the assumption that the rate of reaction is inversely proportional to the concentration of the negative catalyst, was shown to represent the experimental results very closely. The mode in which accurate formulæ representing negative catalysis may be derived was indicated, and the connexion between the accurate and the empirical formulæ pointed out.

*114. "The constitution of scopoletin." By Charles Watson Moore.

Scopoletin, a fluorescent substance obtained from *Scopolia japonica* and several other plants, has been shown to be 4-hydroxy-5-methoxycoumarin, since by prolonged boiling with aqueous potassium hydroxide it is converted into 2:4-dihydroxyanisole. When, however, the alkali hydroxide is allowed to act for a few minutes only on scopoletin, 2:4-*dihydroxy-5-methoxycinnamic acid* is formed. In connexion with the investigation, the following compounds have also been prepared and characterised: 2:4-*Diacetoxyanisole* (m. p. 62—64°); 2:5-*diacetoxyanisole* (m. p. 94°); 2:4:5-*trimethoxycinnamic acid* (m. p. 163—165°); 2:4-*dihydroxy-5-methoxy-β-phenylpropionic acid* (m. p. 69°); the *lactone* of 2:4-*dihydroxy-5-methoxy-β-phenylpropionic acid* (m. p. 155°); the *lactone* of 2-*hydroxy-4-acetoxy-5-methoxy-β-phenylpropionic acid*

(m. p. 135°); 2 : 4 : 5-*trimethoxy-β-phenylpropionic acid* (m. p. 96°); and *methyl* 2 : 4 : 5-*trimethoxy-β-phenylpropionate* (m. p. 54°).

115. "Note on the action of hydrogen dioxide on thiobenzanilide." By Harold Leete and Edward de Barry Barnett.

It has been shown previously (Jacobson, *Ber.*, 1886, **19**, 1068) that 1-phenylbenzothiazole is produced when thiobenzanilide is oxidised in alkaline solution with potassium ferricyanide. The authors now find that when the oxidation is brought about by hydrogen dioxide in alkaline solution, sulphur is eliminated as sulphuric acid, and benzanilide is formed. In neutral solution, however, a compound, $C_{13}H_{11}ONS$, is also formed, and this is the sole product when the oxidation takes place in acid solution. As a similar product is not obtained from benzanilide, it would seem that the oxygen is taken up by the sulphur atom, and this receives confirmation from the insolubility of the substance in alkali. No sulphinic acid appears to be formed, as is the case when hydrogen dioxide acts on thiocarbamide in neutral or alkaline solution (Barnett, *Trans.*, 1910, **97**, 63). In order to bring about the oxidation, the thiobenzanilide (20 grams) was dissolved in alcohol or acetone, a few c.c. of dilute sulphuric acid added, and then 20 grams of a 30 per cent. aqueous solution of hydrogen dioxide. Considerable heat was evolved, and on cooling the oxidation product separated out. This was crystallised from alcohol, and dried in a vacuum over concentrated sulphuric acid:

0·2140 gave 0·5322 CO_2 and 0·0958 H_2O. C = 67·8; H = 4·93.
0·3252 ,, 17·2 c.c. N_2 at 17° and 746 mm. N = 6·02.
0·3042 ,, 0·3118 $BaSO_4$. S = 14·07.
0·1544 in 15·4 naphthalene gave $\Delta t = -0·325°$. M.W. = 216.
$C_{13}H_{11}ONS$ requires C = 68·1; H = 4·80; N = 6·11; S = 13·97 per cent.
M.W. = 229.

Thiobenzanilide oxide forms pale yellow, microscopic needles, which, when rapidly heated, melt at 162—163°, but decompose at a considerably lower temperature on prolonged heating. It is readily soluble in hot alcohol or benzene, or in warm aniline or nitrobenzene, but is insoluble in water or ether.

116. "Purification of acetic acid." By Kennedy Joseph Previté Orton, Muriel Gwendolen Edwards, and Harold King.

Chlorine and bromine do not react with pure acetic acid when light is excluded. Fall in the titre of a solution of bromine in acetic acid, especially if diluted, shows the presence of certain impurities, which are found in the majority of commercial acetic acids. Both fractional distillation and fractional freezing give but small proportions of pure acetic acid.

Distillation from phosphoric oxide, on the other hand, yields 85—90 per cent. of the acid free from these impurities. With the proper precautions only traces, 0·009—0·04 per cent., of acetic anhydride are produced in this treatment.

117. "The detection and estimation of small quantities of acetic anhydride in acetic acid." By Muriel Gwendolen Edwards and Kennedy Joseph Previté Orton.

A method of detecting and estimating small quantities of acetic anhydride in aqueous acetic acids was described. The method is based on the fact that certain anilines, notably 2:4-dichloroaniline, react with acetic anhydride with great rapidity. The anilide can be separated accurately from the aniline, and then indirectly estimated in the form of chloroamine.

118. Tetramethylammonium hyponitrite and its decomposition by heat." By Prafulla Chandra Rây and Hemendra Kumar Sen.

A solution of tetramethylammonium hyponitrite when evaporated in a vacuum over sulphuric acid undergoes partial hydrolysis, resulting in the formation of a basic hyponitrite of the quaternary base.

Nitrous oxide, trimethylamine, nitrogen, and methyl ether are the gaseous products of decomposition of tetramethylammonium hyponitrite; a small fraction of the hyponitrite is also converted into nitrate.

119. "The second and third dissociation constants of orthophosphoric acid." By Edmund Brydges Rudhall Prideaux.

A complete account of the changes in hydrogen ion concentration during the neutralisation of the second and third hydrogen ions of orthophosphoric acid has been prepared, partly from the measurements of Salm (*Zeitsch. physikal. Chem.*, 1907, **57**, 492), and partly from new results. The former results were checked by preparing the solutions in a different way. Equations have been deduced connecting the hydrogen ion concentration of salts of weak polybasic acids with the dissociation constants of these acids.

The second and third dissociation constants of orthophosphoric acid as found by Abbott and Bray (*J. Amer. Chem. Soc.*, 1909, **31**, 730) have been tested by means of these results and equations.

The value $k_2 = 2{\cdot}0 \times 10^{-7}$ has been confirmed, but instead of $k_3 = 3{\cdot}6 \times 10^{-13}$, $k_3 = 3{\cdot}0 \times 10^{-12}$ should be substituted as a result of the present work. The revised constants have been used to construct a general equation which it is hoped will be useful to all who require the standards in question.

120. "Experiments on tautomerism. Part I. The tautomerism of the system X·CHR·CR⁚CR·X, showing the identity of the α- and γ-positions in the glutaconic acid molecule." By Ferdinand Bernard Thole and Jocelyn Field Thorpe.

The elimination of a carbethoxy-group as ethyl carbonate in several instances already published has led to the general conclusion that when the terminal hydrogen atoms in systems of the above type are all replaced the tendency for the compound to acquire the hydrogen atom necessary to enable it to react in its tautomeric form is such that any group capable of replacement by hydrogen is at once eliminated in the presence of a suitable reagent. Numerous experiments in support of this view were described.

It was also shown that α-methylglutaconic acid,

$$CO_2H{\cdot}CHMe{\cdot}CH{:}CH{\cdot}CO_2H,$$

and γ-methylglutaconic acid, $CO_2H{\cdot}CH_2{\cdot}CH{:}CMe{\cdot}CO_2H$, are identical, as are also α-methyl-γ-ethylglutaconic acid,

$$CO_2H{\cdot}CHMe{\cdot}CH{:}CEt{\cdot}CO_2H,$$

and γ-methyl-α-ethylglutaconic acid, $CO_2H{\cdot}CHEt{\cdot}CH{:}CMe{\cdot}CO_2H$.

It was suggested that the cause of the identity of the α- and γ-positions in the molecule of glutaconic acid is of the same order as that determining the equality of the meta-positions in the benzene ring.

121. "Nitrites of the alkylammonium bases: ethylammonium nitrite, dimethylammonium nitrite, and trimethylammonium nitrite." By Prafulla Chandra Rây and Jitendra Nath Rakshit.

These nitrites are prepared by the interaction of silver nitrite and the corresponding amine hydrochloride. Ethylammonium nitrite, when heated, decomposes according to the equation

$$2NEtH_3{\cdot}NO_2 = N_2 + 3H_2O + NEt_2{\cdot}NO.$$

Dimethylammonium nitrite is mainly converted into nitrosodimethylamine, and the decomposition of trimethylammonium nitrite is represented by the equation:

$$3NMe_3H\cdot NO_2 = NMe_3H\cdot NO_3 + 2NO + 2NMe_3 + H_2O.$$

122. "The relation of position isomerism to optical activity. Part IX. The rotation of the menthyl esters of the isomeric fluoro- and iodo-benzoic acids and of the halogen derivatives of the fatty acids." By Julius Berend Cohen.

In a former paper the apparently anomalous optical relation of the ortho-, meta-, and para-iodobenzoic esters was referred to, and in view of the important effect of temperature, to which attention was drawn, it was decided to re-investigate the rotation of these three compounds (previously determined at 20°) at higher temperatures. This has now been done, and the temperature-rotation curves have been plotted at 20° intervals up to 100°. At 20° the rotations of the three isomerides are identical, $[\alpha]_D - 61\cdot5°$, whilst at 100° there is a slight diminution in the case of the ortho-isomeride, $[\alpha]_D - 61\cdot2°$, which is greater in the case of the meta-, $[\alpha]_D - 60\cdot4°$, and greatest in that of the para-, $[\alpha]_D - 58°$.

The three menthyl fluorobenzoates show among themselves a similar relation to that observed among the chlorine and bromine derivatives, the molecular rotations at 20° of the halogen derivatives being as follows:

Menthyl ester.	F.	Cl.	Br.	I.
Ortho	−194·5	−195	−205	−237
Meta...............	236	237	239	237
Para...	239	237	239	237

In order to determine the effect of the halogens on optical activity in the aliphatic series, a large number of halogen fatty esters have been prepared; but apart from the fact that the effect on rotation generally increases with the increasing mass or number of the halogen atoms, no satisfactory generalisation was arrived at.

123. "The constitution of dehydro-β-naphthol sulphide and the interaction of sulphuric acid and aromatic *o*-hydroxysulphoxides." By Thomas Percy Hilditch and Samuel Smiles.

The investigation of the action of sulphuric acid on the sulphoxides of *p*-cresol and *p*-chlorophenol has been continued. It is found that the primary products are isomeric with the original sulphoxides, but contain the cyclic thioxin system. The formation of these substances is explained by assuming the production of a sulphonium-quinone from the *o*-hydroxy-sulphoxide in the same way that the sulphonium-quinones are formed from the *o*-sulphoxides of diphenylmethane and diphenylamine by the action of acids. This hypothesis is further confirmed by the behaviour of dehydro-β-naphthol sulphide, which has been formerly obtained by alkaline oxidation of β-naphthol sulphide. It was shown that this substance has the sulphonium-quinone structure,

$$O\colon C_{10}H_6\colon S\colon C_{10}H_6\colon O,$$

and that it very readily yields naphthathioxin when treated with alcoholic alkali hydroxide.

124. "The action of steam on iron at high temperatures." By John Albert Newton Friend, Thomas Ernest Hull, and Joseph Hallam Brown.

The authors have studied the action of steam on iron at various temperatures up to and including 950°. At 500° the reaction was found to be too slow to admit of being carried to completion. The most favourable temperatures for study were found to lie between 650° and 820°. After five hours' heating at 820°, pieces of iron, 0·05 mm. in thickness, were completely converted into ferroso-ferric oxide. At lower temperatures equilibrium appeared to be obtained between the steam and mixtures of ferrous and ferroso-ferric oxide in varying proportions. The explanation that naturally suggests itself is that the outer layers of the metal have been converted into ferroso-ferric oxide, and the rate of diffusion is so slow at the temperatures under consideration that a practically infinite time is required for the oxidation of the interior portions. It was pointed out, however, that this is not the only explanation. It may be that definite mixtures of ferrous oxide and ferroso-ferric oxide are produced, having a lower dissociation pressure than ferroso-ferric oxide, but higher than ferrous oxide, the mixtures being in equilibrium with the steam at the various temperatures corresponding therewith.

125. "Aromatic antimony compounds. Part II. The action of the chlorides of antimony on aniline and its derivatives." By Percy May.

The action of antimony trichloride on aniline has been referred to by Schiff (*Compt. rend.*, 1863, **56**, 1095) and by Leeds (*Amer. Chem. J.*, 1882, **3**, 137), but their observations are meagre and contradictory, so that a more detailed investigation has now been made. Primary aryl derivatives of antimony, such as *p*-aminophenyldichlorostibine, $NH_2 \cdot C_6H_4 \cdot SbCl_2$, do not appear to be produced, but various additive compounds are formed. The following compounds have been isolated by the action of antimony trichloride on the corresponding amines under various conditions: *Trianiline antimony pentachloride*, $SbCl_5,3NH_2Ph$; *o-toluidine antimony trichloride*, $SbCl_3,C_7H_7 \cdot NH_2$; p-*toluidine antimony trichloride*, and p-*chloroaniline antimony trichloride*,

$$SbCl_3,C_6H_4Cl \cdot NH_2.$$

m- and *p*-Nitroanilines do not combine with antimony trichloride under the experimental conditions employed.

The above-mentioned compounds dissolve in hydrochloric acid, being thereby dissociated into their constituents. The solutions so obtained yield insoluble, crystalline diazo-compounds of the type $R \cdot N_2Cl,SbCl_3$ on treatment with nitrous acid.

Antimony pentachloride reacts violently with aniline, even when both substances are in dilute chloroform solution. It also reacts very vigorously with benzene, toluene, and xylene. In all these cases, partial chlorination of the aromatic compound takes place, the remainder then forming additive products with the antimony trichloride.

126. "Synthetical experiments in the group of the *iso*quinoline alkaloids. Part I. Anhydrocotarninephthalide." By Edward Hope and Robert Robinson.

An account was given of the preparation and properties of anhydrocotarninephthalide, and of a number of its derivatives.

127. "The solubility of electrolytes in aqueous solutions. Part I. Solubility of salts in the corresponding acids." By James Irvine Orme Masson.

Determinations have been made at 30° of the solubilities of sodium chloride and of barium chloride in aqueous hydrochloric acid, and of barium nitrate and of silver nitrate in aqueous nitric acid. The concentrations of acid were such that the solubilities of the salts ranged from 100 per cent. to about 3 per cent. of the values in pure water.

It has been found that the relation of acid concentration to solubility is well expressed by a simple linear differential equation of the first order. The formula also expresses satisfactorily Engel's results for the solubilities of numerous chlorides in hydrochloric acid at 0° (*Compt. rend.*, 1886, **102**, 619; 1887, **104**, 433; *Ann. Chim. Phys.*, 1888, [vi], **13**, 132).

Study of the specific gravities shows that the molecular volumes of water, acid, and salt in saturated solution are to be regarded as constant in a given case; that is, they are independent of the proportions in which the constituents are mixed. By means of equations embodying this, the specific gravities of the solutions can be calculated with considerable accuracy.

128. "The effect of temperature and of pressure on the equilibrium $2CO \rightleftharpoons CO_2 + C$." By Thomas Fred Eric Rhead and Richard Vernon Wheeler.

In Le Chatelier's general formula for equilibrium in gaseous systems:

$$500\int L\frac{dT}{T} + (N' - N)\log_e P + \log_e\frac{C_1^{n_1}\,.\,C'^{n'_1}_1\,.\,.\,.\,.}{C_2^{n_2}\,.\,C'^{n'_2}_2\,.\,.\,.\,.} = k\,;$$

the effect of pressure, measured in atmospheres, is given by the expression $(N' - N)\log_e P$. Using a method of experiment at constant volume different from that previously employed by them (*Trans.*, 1910, **97**, 2182), the authors find that this formula holds for the system $2CO \rightleftharpoons CO_2 + C$ at all pressures between 0·5 and 3 atmospheres for temperatures between 1073° and 1373° Abs. The value of k, however, increases linearly from 19·85 to 20·15 over this range of temperature when the value of L (the total heat of the reaction) is regarded as constant and equal to 39,000 calories, as in their previous communication. The introduction of a value $L_T = L_0 + 2{\cdot}02T - 0{\cdot}0031\,T^2$, calculated from the difference between the molecular heats at constant volume of the factors and products of the system, gives the constant a permanent value, 18·74, L_0 (the total heat of the reaction at absolute zero) being calculated as equal to 38,055 calories.

Le Chatelier's equation therefore becomes, for the system under consideration:

$$\tfrac{1}{2}.\frac{38{,}055 + 2{\cdot}02\,T - 0{\cdot}0031\,T^2}{T} + \log_e P + \log_e\frac{Cco^2}{Cco_2} = 18{\cdot}74,$$

from which the percentage of carbon dioxide and carbon monoxide in equilibrium over excess of carbon can be calculated for any temperature and pressure.

The rate of attainment of equilibrium is extremely slow at temperatures below 1073° Abs.

129. "Nitrites of the benzylammonium series: benzylammonium nitrite and dibenzylammonium nitrite, and their sublimation and decomposition by heat." By Prafulla Chandra Rây and Rasik Lal Datta.

By the interaction of silver nitrite and mono- and di-benzylamine hydrochlorides respectively in aqueous solution, and evaporation in a vacuum of the filtrate, the corresponding nitrites are obtained. The nitrites of this series are more stable than the corresponding ones of the aliphatic series.

130. "The conductivity and viscosity of aqueous solutions of aniline hydrochloride at 25°." By Nevil Vincent Sidgwick and Bernard Howell Wilsdon.

These properties were measured for solutions from $N/10$ to more than $4N$. With increasing concentration the product of conductivity and viscosity first falls, reaching a minimum at about $2N$, and then remains nearly constant, with a slight tendency to rise. The product of the conductivity and the two-thirds power of the viscosity falls continuously.

131. "The solubility of aniline in aqueous solutions of its hydrochloride." By Nevil Vincent Sidgwick, Percival Pickford, and Bernard Howell Wilsdon.

Aniline is miscible in all proportions with water at 168°, and with $4{\cdot}5N$-hydrochloric acid at 30°. The authors have measured the solubility in solutions of various strengths, at temperatures up to complete miscibility. They have also determined at 25° the partition-coefficient (concentration in water/concentration in aniline) of the salt between the two layers. This falls rapidly with increasing concentration, being 20 for a $N/10$- (aqueous) solution, and 0·9 for a $1{\cdot}3N$-solution. The bearing of this on the shape of the solubility curves was discussed.

Some measurements have also been made of the conductivity and viscosity of solutions of the hydrochloride in mixtures of aniline and water. The results appear to indicate that the conductivity for a given concentration of salt is proportional to the amount of water in the solvent.

132. "Some reducing actions of mercury."

By David Borar.

The action of mercury on solutions of a number of substances has been examined with the following results:

(1) Potassium permanganate is reduced to potassium hydroxide and manganese dioxide, the mercury being oxidised to mercuric oxide.

(2) Potassium dichromate in neutral solution is not reduced. In the presence of hydrochloric acid, however, chromium chloride and mercurous chloride are formed.

(3) Ferric salts in the presence of hydrochloric acid are reduced to the ferrous state. The experiments showed that mercury may be used as reducing agent for ferric compounds in the estimation of iron.

(4) Potassium persulphate is reduced to potassium sulphate, the mercury being converted into a basic sulphate.

(5) Copper sulphate in the presence of hydrochloric acid is reduced to cuprous chloride.

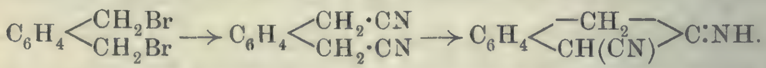
(6) Nitrobenzene in the presence of hydrochloric acid is reduced to aniline to a small extent.

(7) Solutions of potassium nitrate, potassium chlorate, and sodium peroxide are not acted on by mercury to any appreciable extent.

133. "Note on the preparation of β-hydrindone."

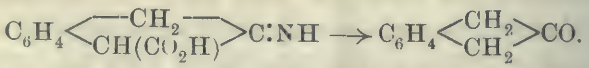
By Jocelyn Field Thorpe.

In a previous paper (Moore and Thorpe, *Trans.*, 1908, **93**, 165) a process was described by which *o*-phenylenediacetonitrile, which is derived from *o*-xylylene dibromide by the action of potassium cyanide, could be quantitatively transformed into β-imino-α-cyanohydrindene by the action of sodium ethoxide, thus:



$$C_6H_4{<}\begin{matrix}CH_2Br\\CH_2Br\end{matrix} \longrightarrow C_6H_4{<}\begin{matrix}CH_2\cdot CN\\CH_2\cdot CN\end{matrix} \longrightarrow C_6H_4{<}\begin{matrix}-CH_2-\\CH(CN)\end{matrix}{>}C{:}NH.$$

It was also shown that β-imino-α-cyanohydrindene could be converted, through the corresponding carboxylic acid, into β-hydrindone:



$$C_6H_4{<}\begin{matrix}-CH_2-\\CH(CO_2H)\end{matrix}{>}C{:}NH \longrightarrow C_6H_4{<}\begin{matrix}CH_2\\CH_2\end{matrix}{>}CO.$$

Since that time it has been found that β-imino-α-cyanohydrindene can be directly converted into β-hydrindone by a much simpler process, and, as the yield by the newer method is 90 per cent. of the theoretical, the preparation of this ketone from *o*-xylene is now an easy matter.

Twenty grams of β-imino-α-cyanohydrindene are dissolved in 50 c.c. of cold concentrated sulphuric acid, and the clear solution is kept at the ordinary temperature for one hour. It is then poured into six times its volume of water, and distilled in a current of steam, a large flask being used for the purpose, as much frothing occurs. β-Hydrindone passes over with the steam, and solidifies in the receiver.

The *semicarbazone* of β-hydrindone, which does not appear to have been prepared previously, separates as a white precipitate when a solution of semicarbazide hydrochloride in aqueous sodium acetate is added to a solution of the ketone in dilute alcohol. It crystallises from hot absolute alcohol, in which it is only sparingly soluble, as slender needles, which melt and decompose at 218°:

0·1803 gave 0·4209 CO_2 and 0·0904 H_2O. C = 63·66; H = 5·57.

$C_{10}H_{11}ON_2$ requires C = 63·5; H = 5·8 per cent.

In the previous paper (*loc. cit.*, p. 174) it was stated that β-hydrindone prepared by this method does not alter on keeping, and it was suggested that the unstable character of this compound when prepared by other methods must be due to the presence of some impurity. This statement was written after the ketone had been under observation for three to four months prior to the publication of the paper. A specimen of β-hydrindone prepared by this method was found, however, to have been completely transformed into a brown, viscid resin after having been kept in a well-stoppered bottle for eighteen months.

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in June next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, June 5th, 1911.

All persons who received grants in June, 1910, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Thursday, June 1st.

The Council wish to draw special attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

FARADAY LECTURE.

The Faraday Lecture will be delivered by Professor Theodore W. Richards, of Harvard University, on Wednesday, June 14th, 1911, at 8 p.m.

The Lecture will be given, by the kind permission of the Managers, in the theatre of the Royal Institution, 21, Albemarle Street, W.

Admission will be by ticket only. Full particulars will be announced in the next number of the "Proceedings."

At the next Ordinary Scientific Meeting on **Thursday**, May **18th**, 1911, at **8.30** p.m., the following papers will be communicated:

"Some reactions of ω-bromomethylfurfuraldehyde." By W. F. Cooper and W. H. Nuttall.

"The course of chemical change in quinol under the action of radiant energy." By W. N. Hartley and O. H. Little.

"A method for the accurate volumetric determination of the oxygen in the air." By H. E. Watson.

"Electrolytic reduction. Part IV. Aromatic aldehydes." By H. D. Law.

"Mannitoboric acid." By J. J. Fox and A. J. H. Gauge.

"The Synthesis of ammonia by heat." By J. S. Cardell and F. Thomas.

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PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 387.

Thursday, May 18th, 1911, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Messrs. E. E. Walker, C. H. Hampshire, H. Christopher, H. F. Harwood, and Noel Deer were formally admitted Fellows of the Society.

THE PRESIDENT announced that a number of valuable chemical works of much historical interest had been presented to the Society by the family of the late Dr. W. J. Russell, F.R.S.; among them was a rare edition of Basil Valentine's *Triumphant Car of Antimony*, bearing an earlier date than the copy in the British Museum.

The Council, at its meeting that afternoon, had passed the following resolution:

> "That the best thanks of the Council be accorded to the family of the late Dr. W. J. Russell, F.R.S., for their generous bequest of a number of chemical works of historical interest."

The PRESIDENT reminded the Fellows that Professor Theodore W. Richards would deliver the Faraday Lecture, entitled, "The Fundamental Properties of the Elements," in the theatre of the Royal Institution, on Wednesday, June 14th, 1911, at 8 p.m.

Certificates were read for the first time in favour of Messrs.:

Norman Ernest Atkinson, Ash Cottage, Thornhill Lees, Dewsbury.
Thomas Cowling, Easingwold, Yorks.
Rudolph Demuth, 68, Salusbury Road, N.W.
Cyril Herbert Koszelski Gonville, Milton, Queen's Road, Buckhurst Hill.
Henry Edmund Linenbröker, 100, Harrow Road, Paddington, W.
Leonard Ison Pitt, B.Sc., 109, Abbott Road, Bromley, E.

A Certificate has been authorised by the Council for presentation to ballot under Bye-law I. (3) in favour of Benjamin Gallsworthy, Thilawa, Burma.

INTERNATIONAL ASSOCIATION OF CHEMICAL SOCIETIES.

At a conference of delegates from the English, French, and German Chemical Societies, held in Paris on April 25th and 26th, it was decided to form an International Association of Chemical Societies. The delegates appointed by the three Societies were:

The Chemical Society, London: Professors Percy Frankland, Meldola, and Sir William Ramsay.

Société Chimique de France: Professors Béhal and Haller, and M. Hanriot.

Deutsche Chemische Gesellschaft: Professors Jacobson, Ostwald, and Wichelhaus.

The following Statutes of the Association, drafted by the delegates at the Paris conference, were approved by the Council of the Chemical Society at their meeting on May 18th.

Statutes.

Art. 1.—Il est fondé une Association internationale des Sociétés chimiques.

Art. 2.—Le but de l'Association est de former un lien entre les Sociétés chimiques du monde, pour s'occuper des questions ayant un intérêt général et international pour la Chimie.

Art. 3.—Toutes les Sociétés chimiques peuvent faire partie de l'Association.

Art. 4.—L'Association est dirigée par un Conseil formé d'un certain nombre de membres. Chaque pays ne peut être représenté dans le Conseil que par une seule Société chimique, qui désignera trois représentants.

Art. 5.—Le Conseil actuel comprend les délégués des Sociétés fondatrices, c'est-à-dire de la Société chimique allemande (Deutsche

chemische Gesellschaft), de la Société chimique anglaise (The Chemical Society, London) et de la Société chimique française (Société chimique de France).

La représentation d'une autre Société dans le Conseil ne pourra etre décidée que par celui-ci, et à la majorité des deux tiers des votants. Le vote par correspondance sera admis dans ce cas.

Art. 6.—Le Conseil fixe à chaque réunion le lieu et l'époque de la prochaine session.

Art. 7.—Le Conseil nomme au début de chaque session un Président, qui est en même temps Président de l'Association, et qui entrera en fonctions à la fin de la Session.

Art. 8.—Le Bureau est constitué par le Président, le Vice-Président et le Secrétaire Général qui sont les délégués du même pays.

Art. 9.—Le Président est chargé de convoquer le Bureau. Celui-ci veille à l'exécution des décisions prises par le Conseil : il fixe l'ordre du jour des Séances du Conseil et entretient des relations entre les diverses Sociétés. Le Président fait approuver les procès-verbaux des séances. Seul le procès-verbal de la dernière séance peut être approuvé par correspondance.

Art. 10.—Les moyens d'action de l'Association consistent :

En nomination de Commissions chargées d'étudier les questions qui leur seront soumises par le Conseil ;

En publication dans les journaux des Sociétés affiliées ou en tout autre mode de publication qu'il conviendra au Conseil de choisir ;

En Conférences et Congrès.

Art. 11.*—Les frais généraux seront supportés par les Sociétés affiliées au prorata du nombre de leurs membres.

Toutes les dépenses autres que les frais généraux ne seront imputables aux diverses Sociétés que sous réserve d'un engagement personnel de ces Sociétés.

Le Secrétaire Général soumettra à chaque session à l'approbation du Conseil le compte-rendu financier de l'exercice écoulé.

Art. 12.—Les modifications aux présents statuts ne pourront être votées qu'à la majorité des deux tiers des membres du Conseil. Le vote par correspondance est encore admis dans ce cas.

The Association proposes, in the first instance, to appoint international committees to consider and report on the following questions :

Nomenclature of Mineral Chemistry ;

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* L'article 11 ne deviendra définitif qu'après l'acceptation des trois Sociétés fondatrices.

Nomenclature of Organic Chemistry;
Unification of the modes of stating physical constants.

Professor Ostwald has been elected President of the Association for the ensuing year, and the next meeting has been fixed for April 13th, 1912, and is to take place in Berlin. The meeting in 1913 will be held in Great Britain.

Of the following papers, those marked * were read:

*134. "Some reactions of ω-bromomethylfurfuraldehyde."

By William Francis Cooper and Walter Harold Nuttall.

ω-*iso*Cyano- or ω-cyano-methylfurfuraldehyde cannot be prepared by the action of potassium or silver cyanide on ω-bromomethylfurfuraldehyde in alcoholic solution; owing to the great reactivity of the bromine atom in the ω-position, condensation of the furfuraldehyde with the alcohol takes place, with the production of ω-ethoxymethylfurfuraldehyde and the liberation of hydrogen bromide. The latter reacts with the silver cyanide, and hydrogen cyanide is evolved.

The same ethoxy-aldehyde may also be prepared by boiling an alcoholic solution of ω-bromomethylfurfuraldehyde with excess of calcium carbonate to neutralise the liberated hydrogen bromide.

ω-*Ethoxymethylfurfuraldehyde* is a yellow oil, readily soluble in the usual organic solvents; it dissolves in hot light petroleum, but is insoluble in the cold. It is also moderately soluble in water. When rapidly distilled, it boils at 235—240° without decomposition, but prolonged heating induces polymerisation. Under 35 mm. pressure it boils at 145°, and it has $D_{15\cdot5}^{15\cdot5}$ 1·1096. It shows all the usual properties of a furfuraldehyde.

The *phenylhydrazone* forms long, slender, yellow needles, melting at 55·5—56·2°, and the p-*bromophenylhydrazone* crystallises in shining, silky needles, melting at 104—105°.

ω-*Ethoxymethylpyromucic acid* is prepared by oxidising the above aldehyde with silver oxide. It is soluble in water, alcohol, ether, benzene, chloroform, or carbon disulphide, but insoluble in light petroleum, and forms long, colourless needles, melting at 57·5—58·5°.

ω-*Methoxymethylpyromucic acid* is obtained by oxidising ω-*methoxymethylfurfuraldehyde* prepared from ω-bromomethylfurfuraldehyde and methyl alcohol. It crystallises in long, silky needles, melting at 67·5—68·5°.

ω-Methoxymethylfurfuraldehyde, on oxidation with alkaline permanganate, gives dehydromucic acid. When ω-bromomethylfurfuraldehyde is boiled with water in the presence of barium carbonate, it gives ω-hydroxymethylfurfuraldehyde; under certain conditions, however, a beautiful yellow, crystalline *compound*, $C_{11}H_{10}O_4$, is obtained, which melts at 111·5—112°. The compound may possibly be a condensation product of ω-bromomethylfurfuraldehyde and lævulic acid, the latter being formed by the decomposition of ω-hydroxymethylfurfuraldehyde:

$$C_6H_5O_2Br + C_5H_8O_3 = C_{11}H_{10}O_4 + HBr + H_2O.$$

DISCUSSION.

Dr. PYMAN pointed out that the conversion of ω-bromomethylfurfuraldehyde into ethoxymethylfurfuraldehyde by means of alcoholic potassium cyanide was analogous to the conversion of 4(or 5)-chloromethylglyoxaline into ethoxymethylglyoxaline under similar conditions (*Trans.*, 1911, **99**, 678). 4(or 5)-Chloromethylglyoxaline hydrochloride could, however, readily be converted into 4(or 5)-cyanomethylglyoxaline by adding its absolute alcoholic solution to ice-cold saturated aqueous potassium cyanide.

Mr. CROSS suggested that the analogous reaction with alcoholic hydroxyl groups of cellulose might explain the limit of resolution of cellulose to ω-bromomethylfurfuraldehyde (Fenton).

Mr. NUTTALL, in reply, said that the authors did not claim that the reaction of ω-bromomethylfurfuraldehyde with potassium or silver cyanide was unique, but merely unusual. A 30—40 per cent. yield of ω-bromomethylfurfuraldehyde could be obtained from cellulose by heating with hydrobromic acid in chloroform solution under pressure at 100°. In addition, a considerable quantity of insoluble "humus" was formed, and for some time the authors had been making an exhaustive examination of this product, and had obtained some interesting acids by oxidation.

*135. "A method for the accurate volumetric determination of the oxygen in air." By Herbert Edmeston Watson.

An apparatus was described, in which about 50 c.c. of air are first measured at constant volume. The gas is then passed into a vessel containing phosphorus, which is warmed, and the residual gas finally reintroduced into the measuring vessel without removal from the apparatus. The accuracy of the method was discussed, and some preliminary results were given. These show that different analyses of the same sample usually agree to 2 parts in 10,000. A complete analysis can readily be performed in an hour and a-half.

DISCUSSION.

Dr. WADE thought that the relative increase in accuracy above that obtainable with Haldane's well-known compensator burette was not commensurate with the comparatively large increase in complexity and in the time required. In his experience the percentage of oxygen in air could be determined by the compensator method with an accuracy of ± 1 part per 1000.

Mr. WATSON, in reply to the President, said that Regnault's method of air analysis was objectionable because it involved the use of moist gases, and for accurate work a compressibility correction had to be applied. Ammonia was also formed by the explosion of air and hydrogen, thereby vitiating the absolute results. Regnault's absolute values were slightly lower than those found with the present apparatus, which agreed with those of Leduc.

*136. "Mannitoboric acid."

By John Jacob Fox and Arthur Josiah Hoffmeister Gauge.

Mannitoboric acid, $C_6H_{15}O_8B$, is prepared from mixtures of mannitol and boric acid dissolved in absolute alcohol. It separates from the alcoholic solutions in tufts of prisms, melting at 89·5°. The acid dissolves readily in water or hot alcohol, but is decomposed by these solvents. Mannitoboric acid behaves as a monobasic acid, and yields normal *ammonium*, *silver*, *calcium*, and *barium* salts. The salts are crystalline powders, soluble in water, and precipitated from aqueous solutions by alcohol.

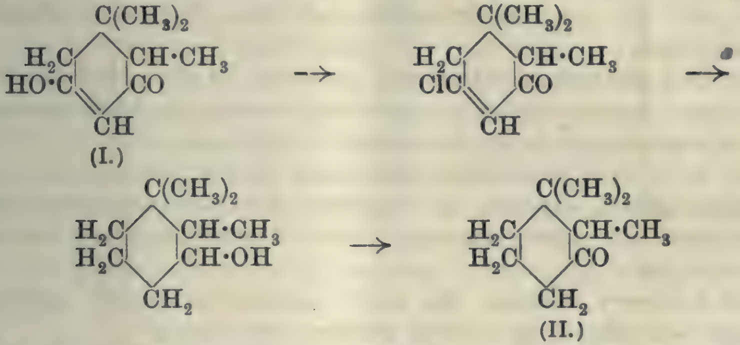
Measurements of the rotations of mixtures of mannitol and boric acid were made, both in alcohol and in water. The results indicate that the formation of mannitoboric acid is favoured by increasing the concentration of either the mannitol or the boric acid.

DISCUSSION.

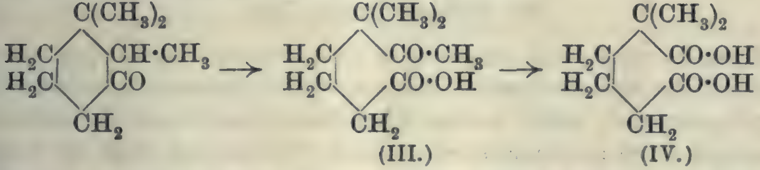
Dr. FOX, in reply to the President, stated that the curves for the rotation of mixtures of mannitol and boric acid in alcoholic solutions appeared to reach a maximum: the fact that it was impossible to dissolve larger quantities of boric acid than those used had prevented the authors from following the curves to their completion. In one or two cases, however, a maximum value had been obtained.

*137. "Hydroaromatic ketones. Part II. 1:1:2-Trimethyl*cyclo*hexan-3-one." By Arthur William Crossley and Nora Renouf.

1:1:2-*Trimethyl*cyclo*hexan-3-one* (II) has been prepared from 1:1:2-trimethyldihydroresorcin (I) by a series of reactions indicated by the following formulæ:



The proof of the constitution of the ketone is afforded by a study of its oxidation products, which are δ-acetyl-δ-methylhexoic acid (III) and αα-dimethyladipic acid (IV):



The preparation of the ketone was originally undertaken with the idea of comparing its properties and transformations with those of camphor, since these two substances show a marked resemblance in the arrangement of the various groupings in their molecules. During the course of the work it became evident that a closer investigation of the properties of trimethyldihydroresorcin and its derivatives was highly desirable, because the molecule is not symmetrical, as in the case of dimethyldihydroresorcin, and the work described shows that many complicated questions of isomerism are involved which are at present being more fully studied.

138. "The course of chemical change in quinol under the influence of radiant energy." By Walter Noel Hartley and Otway Henry Little.

For the purpose of examining the extent to which radiant energy operates on certain organic substances so as to cause a change in constitution and in chemical properties, more than thirty-six experiments were made at different temperatures, on quinol in a state of vapour, in darkness, diffused daylight, and in ultra-violet rays, flasks of glass and of quartz being used. The course of chemical change was measured by the volume of hydrogen evolved.

(1) The reaction $C_6H_4(OH)_2 \rightleftarrows C_6H_4O_2 + H_2$ seems to attain a condition of equilibrium when 0·6 of a milligram-molecule of quinol has lost 6·7 c.c. of hydrogen, and the principal product is quinhydrone.

(2) The reaction is not strictly reversible in the presence of air or oxygen, because under no conditions does the quinhydrone revert to quinone, except in an atmosphere of hydrogen.

(3) In a flask containing crystallised quinol, quinhydrone, and *p*-benzoquinone, exposed to daylight, the *p*-benzoquinone soon disappears, its vapour reacting with the residual quinol to form quinhydrone.

(4) In every instance the most complete and rapid chemical change was effected by rays of shortest wave-length.

139. "Electrolytic reduction. Part IV. Aromatic aldehydes."

By Herbert Drake Law.

Previous work has shown that the aromatic aldehydes, when reduced by the electrolytic method, yield resinous products in varying amount, which is least when the groups round the benzene nucleus occupy a symmetrical position. Deviations from the latter configuration influence the course of the reduction in such a manner that the resin production becomes most prominent when the change in the structure is greatest. This view has now been confirmed in the case of the three monochlorobenzaldehydes. Experiments have also been conducted in a nearly neutral medium, and this change is accompanied by a great decrease in the resin formation.

140. "Synthesis of ammonia by heat."

By Ivor Southwell Cardell and Fred Thomas.

The authors find that ammonia cannot be produced from pure hydrogen and nitrogen, but combination takes place in the presence of oxides of nitrogen.

With nitric oxide the amount of ammonia formed decreases with the increased rate of passage of the gases through the experimental tube, but the reverse holds good in the case of nitrous oxide. This is explained by the relative stability of the two oxides.

141. "A method of chlorination: chlorination of anilines and phenols." By Kennedy Joseph Previté Orton and Harold King.

The method of chlorination, which was described, is based on the reversible interaction between chloroamine and hydrochloric acid, studied by Orton and Jones (*Trans.*, 1909, **95**, 1456). By proper choice of the quantities of hydrochloric acid, any given concentration of chlorine can be obtained. This concentration will remain constant during the chlorination, since a molecule of chlorine used in substitution is replaced by a molecule of hydrogen chloride, which in its turn reacts with a further amount of chloroamine:

$$Ar\cdot NCl\cdot Ac + HCl = Ar\cdot NH\cdot Ac + Cl_2.$$

In this way, oxidation and other side reactions can be avoided, and the operation most effectively controlled.

A few chloro-derivatives of anilines, hitherto unrecorded, were described.

142. "The intermolecular condensation of aromatic sulphinic acids. Part II. The interaction of aromatic disulphoxides and sulphuric acid." By Thomas Percy Hilditch.

The decomposition of aromatic disulphoxides by cold concentrated sulphuric acid was shown to be dependent chiefly on the number and position of the alkyl substituents in the aromatic nucleus. In all cases, however, the primary reaction can only be explained by supposing that the disulphoxide molecule undergoes hydrolytic fission with formation of a mixture of sulphinic and (unstable) sulphoxylic acids:

$$R\cdot SO\cdot SO\cdot R \overset{H_2O}{\rightleftharpoons} R\cdot SO_2H + R\cdot S\cdot OH.$$

These intermediate products may then in certain cases unite to more complex derivatives, such as oxides of the diphenylene disulphides, or, in presence of a phenolic ether, may suffer condensation to simple or complex sulphonium bases, according to the nature of the substitution in the aromatic residue.

The compounds investigated were diphenyl-, di-*p*-phenetyl-, and di-*p*-tolyl methyl ether disulphoxide, both in presence of, and without the addition of, a phenolic ether (phenetole or *p*-tolyl methyl ether).

143. "The action of sodium hypophosphite on copper sulphate in aqueous solution." By James Brierley Firth and James Eckersley Myers.

The authors have examined the above reaction in acid solution, and find that the composition of the product depends on the conditions under which the reaction is carried out. The reaction proceeds through a series of stages, and finally yields a black substance containing hydride, oxide, and phosphate of copper.

This substance, when quite dry, is unstable, and frequently decomposes spontaneously on exposure to air, with the production of water, hydrogen, copper, copper oxide, and copper phosphate.

144. "Note on some metallic compounds of substituted ammonias." By William Robert Lang.

In continuation of his work on the metallic compounds of substituted ammonias (Lang and Rigaut, *Trans.*, 1899, **75**, 883; Lang, *ibid.*, 1903, **83**, 724; Lang and Carson, *Proc.*, 1903, **19**, 147; Lang and Jolliffe, *ibid.*; Lang and Carson, *J. Amer. Chem. Soc.*, 1904, **26**, 758; compare also Girardet, *Bull. Soc. chim.*, 1910, [iv], **7**, 1028), the author has prepared a compound from cuprous thiocyanate and trimethylamine.

Cuprous thiocyanate was carefully prepared, and subjected to the action of an excess of dry trimethylamine, the reaction vessel—similar to that employed in former experiments—being cooled by solid carbon dioxide. After remaining in contact with the copper salt for several days, the excess of methylamine was removed, and the resulting compound examined. A second and third application of trimethylamine, with subsequent drying and weighing, yielded the same result, namely, a compound corresponding with the formula $CuSCN,N(CH_3)_3$.

145. "The decomposition of diethylenesulphidemethylsulphine hydroxide in aqueous solution." By Leila Green and Brenda Sutherland.

The hydroxide corresponding with the salts of diethylenesulphidemethylsulphine decomposes spontaneously into water and a neutral oil (Masson, *Trans.*, 1886, **49**, 233; Mansfeld, *Ber.*, 1886, **19**, 696, 2658; V. Meyer, *ibid.*, 3262). The authors have measured the velocity of this action at 55° in solutions sufficiently dilute to justify the simplifying assumption of total ionisation, using solutions of the pure hydroxide, and also others containing excess of hydroxyl (added sodium hydroxide), or of the sulphine cation (added $C_5H_{11}S_2I$). The results show that the action is of the second order, and that the velocity is directly proportional to the concentration of each of the ions of the sulphine base; or it may be represented by the equation:

$$C_5H_{11}S_2^{\cdot} + OH' = C_5H_{10}S_2 + H_2O.$$

146. “Properties of binary mixtures of some liquefied gases.” By Lancelot Salisbury Bagster.

In a previous paper (*Trans.*, 1910, **97**, 2607) an account was given by the author, in conjunction with Dr. B. D. Steele, of the vapour-pressure curves of binary mixtures of hydrogen sulphide with hydrogen bromide and hydrogen iodide. Hydrogen bromide gave a curve with a minimum, hydrogen iodide a straight line. The freezing-point curves of the above mixtures have been determined in order to ascertain whether there was a corresponding difference. Both curves are of the same type. They are continuous, showing a minimum, but no eutectic point, being of the form produced by a system in which the solid phase consists of mixed crystals. Thus the difference indicated by the vapour-pressure curves is not borne out by the freezing points.

147. “Note on the monosodium salt of 1-nitroso-2-naphthol-3 : 6-disulphonic acid.” By Percy May.

The aqueous solution of the monosodium salt of 1-nitroso-2-naphthol-3 : 6-disulphonic acid, $NO\cdot C_{10}H_4(OH)(SO_3H)\cdot SO_3Na,\frac{1}{2}H_2O$, is orange-red, becoming pink on dilution. Solutions of the neutral salts are dark green, turning to yellowish-green on dilution.

148. “Synthesis of pinacones. Part I.” By William Parry.

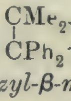
By the action of the appropriate Grignard reagent on ethyl α-hydroxy*iso*butyrate (*Proc.*, 1909, **25**, 305), the following pinacones have been prepared:

(1) Pinacone, which was isolated in the form of its hydrate, $OH\cdot CMe_2\cdot CMe_2\cdot OH,6H_2O$, melting at 44—46°.

(2) *β-Methyl-γ-ethylpentane-βγ-diol*, $OH\cdot CMe_2\cdot CEt_2\cdot OH$; a colourless, viscid oil, boiling at 100°/20 mm., soluble in boiling water. Repeated fractionation under atmospheric pressure results in the elimination of the elements of water with the production of *diethyl*iso*propenylcarbinol*, $CH_2{:}CMe\cdot CEt_2\cdot OH$, which has an odour of camphor, and boils at 150—152°/767 mm.

(3) *β-Methyl-γ-propylhexane-βγ-diol*, $OH\cdot CMe_2\cdot CPr_2\cdot OH$; a colourless, viscid oil, boiling at 105°/15 mm. It cannot be distilled under the ordinary pressure without losing the elements of water.

(4) *αα-Diphenyl-β-methylpropane-αβ-diol*, $OH\cdot CMe_2\cdot CPh_2\cdot OH$; white, silky needles, melting at 89—89·5°, and readily soluble in the

common organic media, with the exception of light petroleum. Acetic anhydride containing one or two drops of sulphuric acid dehydrates it, with the formation, probably, of as-*diphenyldimethyl ethylene oxide*,  $\mathrm{CMe_2 \cdot CPh_2 > O}$, colourless prisms, melting at 44—45°.

(5) *αα-Dibenzyl-β-methylpropane-αβ-diol*,

$$\mathrm{OH \cdot CMe_2 \cdot C(CH_2Ph)_2 \cdot OH};$$

colourless prisms, melting at 47—48°. At the same time a small quantity of an unsaturated alcohol is formed, which distils at 165—168°/12 mm., and is probably *dibenzyl*iso*propenylcarbinol*, $\mathrm{CH_2{:}CMe \cdot C(CH_2Ph)_2 \cdot OH}$.

(6) *αα-Dinaphthyl-β-methylpropane-αβ-diol*,

$$\mathrm{OH \cdot CMe_2 \cdot C(C_{10}H_7)_2 \cdot OH};$$

small, white crystals, melting at 166—166·5°.

The solid pinacones have normal molecular weight in dilute benzene solution.

Experiments are now being conducted with ethyl α-ethyl-α-hydroxybutyrate, which appears to react in a different manner with the magnesium alkyl haloids.

149. "A method for the accurate estimation of traces of water in ether." By Dan Tyrer.

It is occasionally of importance to determine with accuracy the amount of water contained in a sample of "wet" ether. A method susceptible of a great degree of accuracy can be based on the fact that the addition of a little water to ether greatly increases its solvent power for some solutes. The most suitable substance which can be used as a solute is cadmium iodide. According to Eder (*Dingl. Polytech. J.*, 1876, **221**, 189), cadmium iodide is soluble in "absolute" ether to the extent of 28 per cent. Using a very dry sample of ether, it was found by the author, however, that cadmium iodide is practically insoluble in ether. It is to be presumed that the high value obtained by Eder was due to the ether he used containing water and alcohol. In the following table is given the solubility of cadmium iodide at 12° in pure ether and in ether containing various quantities of water. The ether used was Kahlbaum's pure material, prepared from ethyl alcohol, and thoroughly dried by twice distilling over phosphoric oxide.

Grams of water in 100 of ether.	Grams of $\mathrm{CdI_2}$ per 100 of solvent.
0·0	0·143
0·10	0·78
0·30	2·07
0·50	3·36
0·70	4·77
0·90	6·46
1·00	7·30
1·10	8·27
1·14 (saturated)	8·68

The above results were read from a smoothed curve of experimental values. On inspecting the table it will be seen that an addition of 0·1 per cent. of water to dry ether increases the solubility of the cadmium iodide by about 0·64 unit. Now as the solubility can be determined with ease to within an error less than 0·01 unit, the percentage amount of water in the ether can be found to less than 0·001 unit.

This method of analysis might be extended to the determination of traces of water in the alcohols, it being only necessary to find a suitable solute and to obtain a perfectly anhydrous alcohol.

150. "Equilibrium in the system: ethyl alcohol, acetic acid, ethyl acetate and water, and its apparent displacement by hydrogen chloride." By William Jacob Jones and Arthur Lapworth.

The authors find that the equilibrium constant in this liquid system appears to rise from the usually accepted value 4, to at least 8, when hydrogen chloride is present in considerable quantities. No ethyl chloride was formed during the experiments, the whole of the hydrogen chloride being recovered.

The observations are easily accounted for on the assumption that the hydrogen chloride unites with part of the water, and the numbers obtained at 25° suggest that one molecule of hydrogen chloride removes two molecules of water from the sphere of action.

151. "The heat of hydrolysis of ethyl alcohol hydrochloride. A correction." By William Jacob Jones and Arthur Lapworth.

An arithmetical blunder led the authors to record the heat associated with the reaction:

$$C_2H_6O,HCl + H_2O = C_2H_6O + H_2O,HCl,$$

or, more strictly:

$$C_2H_6O,H^{\cdot} + H_2O = C_2H_6O + H_2O,H^{\cdot},$$

in alcoholic solution, as, roughly, 1100 gram-calories. The true value is much greater than this, probably about 4300 gram-calories (compare this vol., p. 101).

152. "Derivatives of silicoethane and silicoethylene." By Frederic Stanley Kipping.

For some time past the author has been making experiments on the linking together of silicon atoms, and in the course of this work he has studied the action of sodium on various aryl and alkylaryl-substitution products of silicon tetrachloride. The investigation is still incomplete, but a preliminary note on the subject seems to be desirable in view of Schlenk, Renning, and Racky's paper on hexaphenylsilicoethane, which has just been published (*Ber.*, 1911, **44**, 1178).

Hexaphenylsilicoethane, $SiPh_3{\cdot}SiPh_3$, was prepared from triphenylsilicyl chloride by the author more than a year ago; it crystallises well from tetrachloroethane, and melts at about 360°.

The compounds obtained from the disubstitution products of silicon tetrachloride have properties very different from those of this saturated substance; from phenylethylsilicon dichloride, for example, a compound having the composition of *diphenyldiethylsilicoethylene*, $SiPhEt{:}SiPhEt$, is easily produced, but it is a vitreous and easily fusible solid, readily soluble in most of the common solvents, except the alcohols.

ADDITIONS TO THE LIBRARY.

Presented by the Family of the late Dr. W. J. Russell, F.R.S.

Accum, *Fredrick.* Description of the process of manufacturing coal gas, . . . with elevations, sections and plans. pp. xvi + 334. ill. London 1819.

Barlow, [*Peter*]. Barlow's Tables of squares, cubes, square roots, cube roots, reciprocals of all integer numbers up to 10,000. Stereotype edition, examined and corrected. pp. viii + 200. London 1840.

Berzelius, *Jöns Jacob.* Essai sur la théorie des proportions chimiques et sur l'influence chimique de l'électricité. Traduit du Suédois. pp. xvi + 190 + [ii] + 120 + [ii]. Paris 1819.

Birch, *Thomas.* The life of the Honourable Robert Boyle. pp. [iv] + 458 + [xvi]. London 1744.

Boyle, *Robert.* Philosophical works, Abridged . . . by *Peter* **Shaw**. 2nd edition, corrected. 3 vols. pp. [iv] + xliii + 730, xx + 726, [iv] + xv + iv + 756. ill. London 1738.

—— See **Birch**, *Thomas.*

Davy, *Sir Humphry.* See **Paris**, *John Ayrton.*

Kopp, *Hermann.* Die Entwickelung der Chemie in der neuren Zeit. pp. xxii + 854. München 1873.

Lavoisier, *Antoine Laurent.* Traité élémentaire de chimie, présenté dans un ordre nouveau et d'après les découvertes modernes. 2nd edition. pp. xliv + 322, viii + 327. Paris 1793.

Paris, *John Ayrton.* The life of Sir Humphry Davy. 2 vols. pp. xvi + 416, viii + 463. London 1831.

Pellatt, *Apsley.* Curiosities of glass-making. With details of the processes and productions of ancient and modern ornamental glass manufacture. pp. vi + 146. ill. London 1849.

Valentine, *Basil.* The triumphant chariot of antimony, being a conscientious discovery of the many reall transcendent excellencies included in that minerall. Faithfully Englished and published for the common good by J. H. Oxon. Printed for Thomas Bruster, and are to be sold at the three Bibles neere the West end of Paules Church-Yard in London, 1660.

A rare first edition not mentioned in the bibliographies and differing from the 1661 edition in date and publisher.

THE FARADAY LECTURE.

The Faraday Lecture, entitled, "The Fundamental Properties of the Elements," will be delivered by Professor Theodore W. Richards, of Harvard University, on Wednesday, June 14th, 1911, at 8 p.m.

The Lecture will be given, by the kind permission of the Managers, in the theatre of the Royal Institution, 21, Albemarle Street, W.

Admission will be by ticket only. Each Fellow of the Society is entitled to two tickets, which may be obtained on application to the Assistant Secretary, Chemical Society, Burlington House, W.

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in June next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, June 5th, 1911.

All persons who received grants in June, 1910, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Thursday, June 1st.

The Council wish to draw special attention to the fact that the income arising from the donation of the Worshipful Company Goldsmiths is to be more or less specially devoted to the enc agement of research in inorganic and metallurgical chemi Furthermore, that the income due to the sum accruing from Perkin Memorial Fund is to be applied to investigations relat problems connected with the coal-tar and allied industries.

At the next Ordinary Scientific Meeting on **Thursday,** June st, 1911, at **8.30** p.m., the following papers will be **communicated:**

"The dissociation pressures of the alkali bicarbonates. Part I. Sodium hydrogen carbonate." By R. M. Caven and H. J. S. Sand.

"The absorption spectra of cinchonine, quinine, and their isomerides." By J. J. Dobbie and A. Lauder.

"The influence of conjugated linkings on general absorptive power. Part II. Some open-chain and cyclic compounds." By C. R. Crymble, A. W. Stewart, R. Wright, and Miss F. W. Rea.

"The constituents of the bulb of *Buphane Disticha.*" By F. Tutin.

"New derivatives of aminolauronic acid." By J. Weir.

"The triazo-group. Part XVIII. β-Triazoethylamine." By M. O. Forster and S. H. Newman.

"The interaction of formic acid and cellulose." By C. F. Cross and E. J. Bevan.

"Configuration of the stereoisomeric dibromosuccinic acids." (Preliminary note.) By A. McKenzie.

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PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 388.

Thursday, June 1st, 1911, at 8.30 p.m., Professor Percy F. Frankland, LL.D., F.R.S., President, in the Chair.

Messrs. Ralph Roscoe Enfield, Victor John Harding, and Arthur A. Eldridge were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Percy James Raymond, 20, Arboretum Road, Worcester.
Ernest Vanstone, B.Sc., Gwynfe House, Mount Pleasant, Neath.

Of the following papers, those marked * were read:

***153. "The dissociation pressures of the alkali bicarbonates. Part I. Sodium hydrogen carbonate." By Robert Martin Caven and Henry Julius Salomon Sand.**

The dissociation pressures of sodium carbonate monohydrate and of sodium hydrogen carbonate have been examined by means of a specially designed tensimeter.

Difficulty was experienced in the latter case, particularly from the formation of impermeable crusts on the bicarbonate. Satisfactory results were obtained only when the amount of bicarbonate employed was four or five hundred times that theoretically required to evolve the necessary volume of gas at the highest temperature reached in the experiments.

It was found that the vapour pressure, in mm. of mercury, of sodium carbonate monohydrate can be represented with sufficient accuracy by the equation: $\log p = 10{\cdot}825 - \frac{3000}{T}$, and that of sodium hydrogen carbonate by the equation: $\log p = 11{\cdot}8185 - \frac{3340}{T}$.

From these equations the heat of dissociation of one gram-molecule of sodium carbonate monohydrate is calculated to be 13,800 calories, and that of two gram-molecules of sodium hydrogen carbonate to be 30,700 calories. The latter figure is in sufficient agreement with the number 29,700 calculated from thermochemical results given by de Forcrand (*Compt. rend.*, 1909, **149**, 719).

The pressures corresponding with the four-phase equilibrium—anhydrous sodium carbonate, sodium carbonate monohydrate, sodium hydrogen carbonate, vapour—have also been calculated.

*154. "The absorption spectra of cinchonine, quinine, and their isomerides." By James Johnston Dobbie and Alexander Lauder.

The authors have examined the absorption spectra of cinchonine, quinine, and their isomerides, and find that each alkaloid gives two distinct spectra, *A* and *B*, the band in *B* being more sharply defined and much more persistent than the band in *A*. The spectrum *A* is obtained when the alkaloid is dissolved in alcohol or in water containing not more than one equivalent of acid to one of the base; the spectrum *B* when it is dissolved in water containing at least two equivalents of acid to one of the base.

The difference between the two spectra was shown to be associated with the fact that the nitrogen of the quinoline nucleus is tervalent in the former, but quinquevalent in the latter case.

It was further shown that the spectrum *A* of cinchonine is practically identical with the spectrum of quinoline in alcohol, and the spectrum *B* with the spectrum of quinoline salts in aqueous solution. This is explained by the circumstance that the whole of the molecule of the alkaloid, except the quinoline nucleus, is, according to the generally accepted view of the constitution of the alkaloid, completely reduced, and reduced rings, as is well known, cause no selective absorption.

The absorption spectra of the isomerides examined are indistinguishable from those of cinchonine and quinine respectively.

*155. "The constituents of the bulb of Buphane disticha."

By Frank Tutin.

Buphane disticha, Herb., is a bulbous plant, indigenous to South Africa, and has long been known to possess toxic properties.

The living, inner portions of the bulb contain an abundant amount of alkaloid, whilst the dry, outer layers are free from such a substance.

An alcoholic extract of the inner portions of the bulb, when distilled with steam, yielded a small amount of an essential oil containing furfuraldehyde.

The portion of the non-volatile product which was soluble in water yielded a small amount of acetovanillone (4-hydroxy-3-methoxyacetophenone), a quantity of chelidonic acid, and considerable amounts of copper and lævulose. It also gave a mixture of alkaloids, the principal constituent of which is an amorphous, strongly basic product, designated *buphanine*, which possesses a physiological action similar to that of hyoscine. A weakly basic alkaloid, and one soluble in water, together with small amounts of narcissine, $C_{16}H_{17}O_4N$, were also obtained. The weakly-basic alkaloid is a convulsant poison, whilst the base soluble in water resembles colchicine and narcissine in its action.

Buphanine, on hydrolysis, is converted into a crystalline alkaloid, *buphanitine*, $C_{23}H_{24}O_6N_2$, which melts at 240°. *Buphanitine hydrochloride* and *methiodide* were also prepared.

The portion of the original extract which was insoluble in water consisted of amorphous products, together with pentatriacontane, a phytosterol, ipuranol, $C_{23}H_{38}O_2(OH)_2$, and a mixture of fatty acids, both free and combined.

*156. "The interaction of formic acid and cellulose."

By Charles Frederick Cross and Edward John Bevan.

Derivatives of cellulose obtained by direct interaction with formic acid, and also in presence of catalysts, have been investigated, and the quantitative data as to composition and decomposition (saponification both by alkalis and acids) are not reconcilable with the view that the products are simple esters of a normal cellulose.

Other modes of action of formic acid are known, and may explain the observed anomalies.

The interaction of cellulose and simple hydroxy-compounds was described, particularly in the case of resorcinol, which yields a well crystallised product, the alkaline solutions of which are crimson.

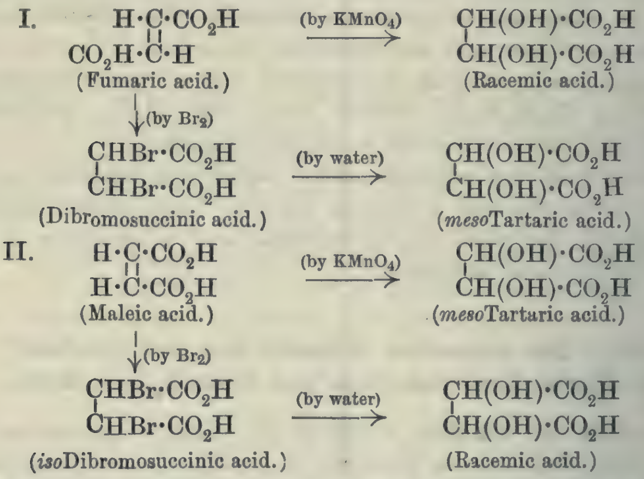
The quantitative data accord with a C_{13} formula.

This evidence, on the one hand, and the well known changes of the hexoses under the action of condensing acids on the other, were considered in relation to the interaction of formic acid and cellulose, in which more than one of the possible functions of the acid are involved.

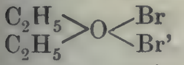
*157. "Configuration of the stereoisomeric dibromosuccinic acids." (Preliminary note.) By Alex. McKenzie.

Dibromosuccinic acid is formed by the action of bromine on fumaric acid, whilst maleic acid gives *iso*dibromosuccinic acid, Although a large amount of research has been devoted to these dibromo-acids, the question of their configuration had not been settled. Obviously, one of them must be resolvable into optically active components, and the other must be of the *meso*-type. The author finds that the *iso*-acid is the resolvable form.

The author was led to examine this problem by a consideration of the Walden inversion, on the one hand, and of the following changes, which are recorded in the literature, on the other:



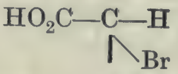
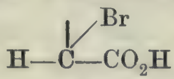
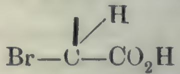
In the displacement of the halogen by the hydroxy-groups in these cases, it was conceivable that one had to deal with a change of configuration, or, in other words, with a process which was equivalent to a Walden inversion with optically inactive material. The other alternative was that the direct hydroxylation of fumaric and maleic acids with permanganate followed a stereochemical course of a different order from that followed by the direct addition of bromine. The experiments of the author are in favour of the latter view. Further, since the oxidation of fumaric and maleic acids by permanganate does not apparently lead to the formation of a mixture of *r*- and *meso*-tartaric acids, it appears likely that a change of configuration takes place during the addition of bromine.

*iso*Dibromosuccinic acid was prepared by the action of bromine on maleic acid in the presence of ether. The experimental conditions may be regulated so that practically no fumaric acid is produced, and the course of action depends to a remarkable degree on the quality of the ether used. The oxonium complex,  $\begin{matrix}C_2H_5\\C_2H_5\end{matrix}>O<\begin{matrix}Br\\Br\end{matrix}$, described by Tschelinzeff, is possibly produced as an intermediate phase.

The ease with which the bromine in the *iso*-acid is displaced renders the resolution a difficult one. A partial resolution was, however, effected by means of morphine, using methyl alcohol as solvent.

Morphine (21 grams, 1 mol.) was dissolved in warm methyl alcohol (290 c.c.), and, when the temperature of the solution was 46°, 19 grams (1 mol.) of the *iso*-acid were added in one instalment. The solution of the acid was immediately followed by the separation of glassy crystals of a morphine salt. After twenty-four hours at about 15°, the crystals (22 grams) were removed. So far, it has not been found practical to crystallise further the salt which separates under these conditions. The resulting acid was strongly lævorotatory, giving $[\alpha]_D -100{\cdot}7°$ for $c = 8{\cdot}6$ in ethyl acetate solution. The mother liquor, from which the morphine salt had been removed, gave a dextrorotatory acid. 6·5 Grams of the acid with $[\alpha]_D -100{\cdot}7°$ were then treated with a solution of 7·1 grams of morphine in 100 c.c. of methyl alcohol. The resulting crystals (9·5 grams) gave an acid with $[\alpha]_D -114{\cdot}5°$ for $c = 7{\cdot}4$ in ethyl acetate solution. The latter acid (2·5 grams) was again acted on by a solution of 2·8 grams of morphine in 80 c.c. of methyl alcohol. The yield of salt was 3·5 grams, and the acid from this gave the value $[\alpha]_D -118°$ for $c = 8{\cdot}47$ in ethyl acetate solution. So far, there is no evidence to show that this acid is the pure *l*-isomeride, and the work is being continued with the view of obtaining the latter.

DISCUSSION.

The PRESIDENT pointed out that the great interest attaching to Dr. McKenzie's investigation was that he had definitely fixed the Walden inversion as taking place in the passage from fumaric to dibromosuccinic acid and in that from maleic to *iso*dibromosuccinic acid respectively. In previously investigated Walden changes it was always uncertain whether the inversion took place in the introduction of the halogen or in its removal. Although in the present case the inversion took place in inactive material, it appeared to him that it was actually brought about by the presence of asymmetric groupings within the molecules concerned. Thus if, according to accepted views, the double linking in fumaric acid were opened up, for example, by the addition of two atoms of bromine, the normal result must be the formation of a *racemic* compound, and if instead a *meso*-compound were produced it must depend on an atom of bromine and an atom of hydrogen exchanging places in one of the two halves of the molecule. Such an interchange could, according to accepted views on asymmetry, only be effected under the directing influence of asymmetric matter itself, as towards symmetric matter the two alternative groupings were in every respect equivalent. Such asymmetric directive influence appeared to him to be available in the present instance as soon as one atom of bromine had become attached, for the resulting asymmetric grouping  $\underset{|\diagdown \mathrm{Br}}{\mathrm{HO_2C{-}C{-}H}}$ would influence the configuration of the asymmetric grouping built up in the other half of the molecule, when the second atom of bromine became attached, with the result, as appeared from the author's experiments, that instead of the grouping:  $\overset{|\diagup \mathrm{Br}}{\mathrm{H{-}C{-}CO_2H}}$, there was obtained  $\overset{|\diagup \mathrm{H}}{\mathrm{Br{-}C{-}CO_2H}}$.

The same reasoning applied to the formation of the racemic *iso*dibromosuccinic acid from maleic acid.

One was naturally led to inquire as to what asymmetric agency directed the transformation of one enantiomorph into the other in the case of the ordinary Walden inversions, and he wished to suggest that an asymmetric grouping which might exert such a directive influence was to be found in the probable combinations (by association or otherwise) of molecules of the optically active compound undergoing the halogenation of hydroxy- or amino-groups or the hydrolysis or amidation of halogen groups (these being the reactions in which the inversion had been found to take place). This hypothesis was in accord with the observations of Emil Fischer that optically active acids and their esters or their glycines often behaved differently, and again that different bases had different effects in respect of inversive action when used for the hydrolysis of optically active halogen compounds. Such different bases might be expected to alter profoundly the condition of association or of other state of combination in which the halogen compounds might exist, besides altering the nature of the asymmetric grouping which was influencing the asymmetric group actually undergoing hydrolysis.

This hypothesis also indicated the possibility of a single enantiomorph (or the preponderance of one enantiomorph) emerging from a reaction in which an asymmetric grouping was, during a reaction, temporarily transformed into an unsaturated one.

Dr. SENTER, with reference to the President's suggestion that the intermediate formation of bimolecular compounds might play a part in the Walden inversion, said that he had recently obtained evidence of the formation of such a compound, namely,

$$CH_2Br\cdot CO_2\cdot CH_2\cdot CO_2Na,$$

in the hydrolytic decomposition of sodium bromoacetate. The final product, glycollic acid, was formed both by the hydrolysis of this compound and by the direct hydrolytic decomposition of sodium bromoacetate, in proportions depending on the dilution and temperature. As regards the further explanation of the formation of active compounds based on the assumption of the successive addition of bromine atoms at a double bond, it would be interesting to know if there was any direct evidence of such a mode of addition. The available evidence appeared to show that free oxygen, and also hydrogen, always combined as whole molecules, with subsequent rearrangement, but other elements, including the halogens, might behave differently in this respect.

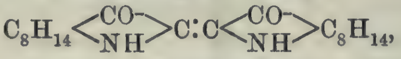
158. "The influence of conjugated linkings on general absorptive power. Part II. Some open-chain and cyclic compounds." By Cecil Reginald Crymble, Alfred Walter Stewart, Robert Wright, and Florence Williamson Rea.

In continuation of the previous work on this subject, an examination has been made of the absorption spectra of isomeric substances containing double bonds in different positions in the molecule. Eighteen spectra have been compared in the case of isomeric substances, and it has been found that in every case the conjugation of double linkings increases the general absorptive power of the compound. This influence is specially marked in the case of two other substances, namely, crotonic acid and allylacetic acid; for here, although the former compound contains fewer atoms and has the same number of double bonds, yet its absorptive power is very much more marked than that of the latter, in which the double bonds are not conjugated with each other. An attempt has been made to detect the influence on general absorption of two unsaturated groups placed far apart in a chain, but near together in space; the results, however, have not been positive.

159. "New derivatives of aminolauronic acid."

By John Weir.

In the course of a research, the objects of which were: (1) the preparation of the camphor analogue of indigo,

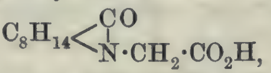


$$C_8H_{14}<\substack{CO-\\NH}>C{:}C<\substack{CO-\\NH}>C_8H_{14},$$

and (2) the preparation of a diaminocamphor, $NH_2\cdot C_8H_{14}\cdot NH_2$, the following new compounds have been obtained.

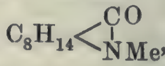
(1) *Carboxymethylaminolauronic acid*, $CO_2H\cdot C_8H_{14}\cdot NH\cdot CH_2\cdot CO_2H$, a crystalline solid, melting at 183—184°, and having $[\alpha]_D^{18°}$ in water $+45\cdot7°$.

(2) N-*Anhydrocarboxymethylaminolauronic acid*,



$$C_8H_{14}<\substack{CO\\|\\N\cdot CH_2\cdot CO_2H,}$$

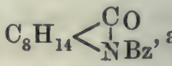
a crystalline solid, melting at 142—143°, and having $[\alpha]_D^{19°}$ in water $-22\cdot2°$, in alcohol $-11\cdot6°$, and in benzene $-22\cdot2°$.



(3) *Anhydromethylaminolauronic acid*, $C_8H_{14}<\substack{CO\\|\\NMe}$, an orange-coloured wax.

(4) *Benzoylaminolauronic acid*, $CO_2H\cdot C_8H_{14}\cdot NHBz$, a crystalline solid, melting at 204°, and having $[\alpha]_D^{19°}$ in alcohol $-18\cdot4°$.

(5) *Methyl benzoylaminolauronate*, a crystalline solid, melting at 88—89°, and having $[\alpha]_D^{18°}$ in alcohol $-28\cdot9°$.



(6) N-*Anhydrobenzoylaminolauronic acid*, $C_8H_{14}<\substack{CO\\|\\NBz}$, a crystalline solid, melting at 71—72°, and having $[\alpha]_D^{18°}$ in alcohol $-69\cdot1°$.

The two main objects of the work were not realised.

160. "The triazo-group. Part XVIII. β-Triazoethylamine."

By Martin Onslow Forster and Sidney Herbert Newman.

β-Triazoethylamine, $N_3\cdot CH_2\cdot CH_2\cdot NH_2$, obtained from the product of heating β-bromoethylamine hydrobromide with sodium azide, is a colourless oil, which distils at 63·5°/50 mm., and has D^{16} 1·0488. It is reduced to ethylenediamine by stannous chloride in hydrochloric acid. The *hydrochloride*, with the *benzoyl*, p-*toluenesulphonyl*, *phthalyl*, and p-*nitrobenzylidene* derivatives, have been prepared, together with the *carbamide*, *phenylcarbamide*, and *phenylthiocarbamide*.

Unlike the corresponding halogen derivatives, β-triazoethylamine is not converted into dimethyleneimine by the action of the alkalis, thus offering an unusual contrast between the azoimide complex and the halogen atoms.

161. "The interaction of metallic oxides and phosphoryl chloride, alone and in the presence of certain organic compounds." By Henry Bassett, jun., and Hugh Stott Taylor.

Several metallic oxides react readily with phosphoryl chloride to give well defined double compounds. The following have been obtained: $CaO,2POCl_3$; $CaO,3POCl_3$; $MgO,2POCl_3$; $MgO,3POCl_3$; $MnO,3POCl_3$; $ZnO,3POCl_3$. These compounds crystallise well, but are very sensitive to moisture, for which reason they are difficult to obtain quite pure.

All the other oxides investigated (CoO, CdO, CuO, Cu_2O, HgO, Al_2O_3, Fe_2O_3) react more or less readily with phosphoryl chloride, but in these cases large quantities of the metallic chlorides are formed. The mechanism of this chloride formation was discussed, and reasons and experiments were brought forward which favour the view that it is preceded by the formation of an additive compound of the oxide and phosphoryl chloride.

The double compounds of metallic oxides and phosphoryl chloride yield a series of well crystallised derivatives with acetone, ether, and various esters, for example, $CaO,P_2O_3Cl_4,2Me_2CO$;

$MgO,P_2O_3Cl_4,2CH_3\cdot CO_2Et$; $MnO,P_2O_3Cl_4,2CH_3\cdot CO_2Et$.

These organic derivatives are quite easily obtained by dissolving the appropriate oxide in a solution of phosphoryl chloride in acetone, ethyl acetate, etc. Hydrogen chloride is liberated owing to the action of traces of moisture with formation of these derivatives of the compound $P_2O_3Cl_4$. Their ready formation supports the view that this compound is one of the first products of the action of moisture on phosphoryl chloride.

162. "A copper derivative of quinol."
By Hugh Vernon Thompson.

An investigation into the effect of organic oxidising agents on copper showed that a solution of *p*-benzoquinone in ethyl acetate containing traces of acetic acid readily attacks copper.

The first product of the reaction is normal copper acetate, $Cu(C_4H_6O_4),H_2O$, whilst after prolonged immersion the copper becomes coated with a crystalline deposit varying in colour from orange-red to brick-brown, and the solution also turns a red colour.

Subsequent work showed that the deposit could be obtained in crystalline pellets of a deep port-wine colour by dissolving a little *p*-benzoquinone in 30 c.c. of ethyl acetate to which 4 to 5 drops (about 0·07 gram) of glacial acetic acid had been added; in this solution thin copper foil is placed so as to be only partly immersed, and the temperature kept at 10—15° for one or two days. The substance cannot be purified by ordinary means owing to its insolubility or instability in common solvents; the mean value calculated from a series of analyses gave C = 30·61; H = 3·57; Cu = 33·16 per cent., corresponding with an empirical formula, $C_5H_7O_4Cu$.

Since the initial product in the reaction is copper acetate, it is probable that the red deposit is a molecular compound containing copper acetate, in which case the molecular formula must be at least twice the empirical formula, namely, $C_{10}H_{14}O_8Cu_2$. If we assume that this is the correct molecular formula, the composition can be expressed as:

$$(a)\ C_6H_6O_2,CuO,Cu(C_4H_6O_4),H_2O,$$
$$\text{or } (b)\ C_6H_6O_2Cu,Cu(C_4H_6O_4),2H_2O.$$

That the substance is a molecular compound of hydrated copper acetate and a copper derivative of quinol follows from the facts that decomposition by glacial acetic acid in ether gives quinol and the salt $Cu(C_4H_6O_4),H_2O$, and that on gently heating the compound in an atmosphere of carbon dioxide *p*-benzoquinone and water are liberated, leaving a residue of metallic copper and anhydrous copper acetate.

The compound can be obtained in small amounts by other methods, but the quinol derivative has not yet been isolated from the copper acetate.

Nitric acid reacts with this compound to give a yellow, crystalline substance, which is either a mixture of copper picrate and copper oxalate of approximately constant composition, or a molecular compound of the two salts of the composition:

$$2[(C_6H_2O_7N_3)_2Cu,5H_2O],7(C_2O_4Cu,H_2O).$$

163. "The action of salt solutions and of sea-water on iron at various temperatures." By John Albert Newton Friend and Joseph Hallam Brown.

The authors exposed thin plates of pure iron to the corrosive action of various concentrations of common salt and of sea-water at different temperatures. Below 13° it was found that dilute solutions exert a more corrosive action than distilled water at the same temperature; above 13°, on the other hand, they exert a less corrosive action. At 13° the corrosive action is practically the same for dilute solutions of common salt, for ordinary sea-water, and for distilled water. This temperature is therefore styled by the authors the "Inversion Temperature."

164. "Some derivatives of gelsemine." By Charles Watson Moore.

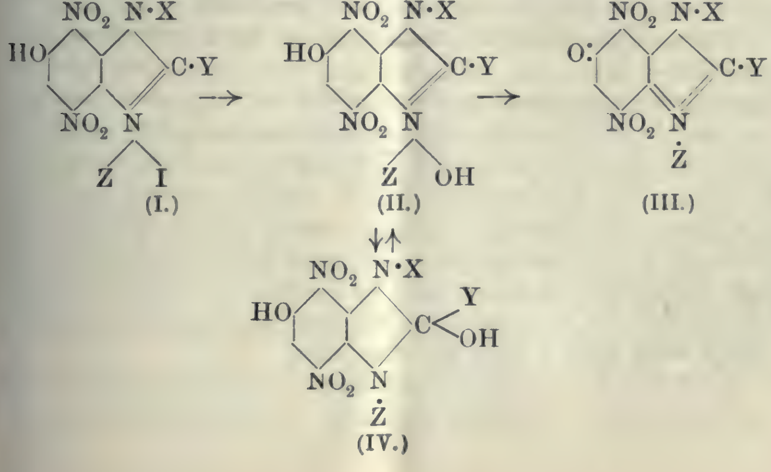
Gelsemine, $C_{20}H_{22}O_2N_2$, is stable towards alkali hydroxides and reducing agents. By treatment with oxidising agents, on the other hand, the molecule is decomposed, and no definite products have been obtained by this means.

On boiling gelsemine with concentrated hydrochloric acid for some hours, three new bases are formed, which have been designated as apo*gelsemine*, isoapo*gelsemine*, and *chloro*-isoapo*gelsemine*. Of these, *apo*gelsemine, $C_{20}H_{24}O_3N_2$, is the chief product of the reaction, and although it cannot be crystallised, it yields well characterised, crystalline derivatives. Chloro-*isoapo*gelsemine, $C_{20}H_{23}O_2N_2Cl$, and its hydrolytic product, *isoapo*gelsemine, $C_{20}H_{24}O_3N_2$, are only formed in relatively small amounts. Both these bases crystallise readily, and they, and several of their derivatives, have been characterised.

It has also been observed that when *gelsemine methyl hydroxide* is heated at 200° in aqueous solution, the expected gelsemethine is not produced, the methyl hydroxide losing methyl alcohol with regeneration of gelsemine.

165. "Syntheses with phenol derivatives containing a mobile nitro-group. Part IV. Quinone-imides, asymmetric quaternary ammonium compounds, and asymmetric carbinols." By Raphael Meldola and Harold Kuntzen.

Setting out from the iminazoles obtained by the action of primary amines on trinitroacetylaminophenol, it was shown that iminazolium iodides (I) can be obtained by heating the iminazoles with alkyl iodides, the resulting compounds being hydrolysable with the formation of the iminazolium hydroxides (II). The latter, on heating, lose water, and pass into quinone-imides (III), and on solution in alkali are transformed into the isomeric carbinols (IV):



It was pointed out that compounds of the types I and II contain an asymmetric nitrogen atom of the form O:N a b c, and should therefore be resolvable into optically active antipodes. The carbinol form (IV) also contains an asymmetric carbon atom, and should be resolvable. As the carbinols and iminazolium hydroxides are interconvertible, the interesting possibility is thus offered of transferring optical activity from a nitrogen to a carbon atom. Type III represents a new class of quinone-imide derivatives, for which the authors propose the name of *iminazolones*. The carbinols (IV) are named, in accordance with precedent, *iminazolols*. Several compounds of each series were described.

166. "Note on a colour change in β-paranitrophenol brought about by sunlight." By Thomas Vipond Barker.

p-Nitrophenol yields two modifications which have been examined crystallographically by the author (*Zeitsch. Kryst. Min.*, 1907, **44**, 159). The two modifications possess great similarity in the values of their prism angles; that they are quite distinct, however, follows from the observed transformation of one into the other on heating under the microscope. The transition temperature, if one really exists, has not been accurately determined, but the author's observations would seem to point to a temperature of 63°, for a saturated toluene solution yields crystals of either modification according as the temperature is above or below 63°. That modification which appears at high temperatures will henceforth be termed *α*, the other *β*.

The *α*-modification is almost colourless, being of a very pale lemon-yellow tint. The *β*-modification, on the other hand, is of a pronounced yellow colour; but on allowing it to remain for some time the crystals were found to acquire gradually a red tinge on the surface. The *α*-crystals, on the other hand, preserved their original tint.

Experiments were therefore made under varying conditions, and it was soon found that the red coloration appears only when the crystals are exposed to sunlight. The brighter the light the quicker is the change; in dull weather crystals may be exposed for many days without any appreciable change, whilst on a bright day the red coloration is apparent after an hour or so. Absolutely no change takes place if the crystal be kept in the dark. A tube which has been kept wrapped up in black paper presents no trace of change, even after a lapse of seven years.

It was at first thought that the coloration might possibly be due to the formation of an ammonium salt. That this is not the case is proved by the fact that the change proceeds in a desiccator over sulphuric acid, and again when the desiccator is filled with hydrogen or carbon dioxide. The change, although quickly enough detected by the eye, must in reality be a very slow process, since crystals after some months' exposure still present a yellow nucleus, and it is likely that the red material acts as a protection against further change by absorbing the actinic rays.

It is very remarkable that the α-modification is wholly unacted on. Of this there can be no doubt, as the following will show. Solutions in water at the ordinary temperature yield crystals, the great majority of which are those of the β-modification, but, in addition, some crystals of the α-modification also appear. Owing to the similarity in habit, it is often impossible without an actual measurement on the goniometer to distinguish between crystals of the two modifications. The whole of one crop thus obtained was collected into a tube, and exposed to sunlight for some time; all the crystals with the exception of two turned red after a few hours. The action was allowed to proceed for a few months; but even after this prolonged treatment the two crystals still failed to show the slightest trace of change. They were therefore taken out, and measured on the goniometer, and proved to be crystals of the α-modification. A few of the red crystals selected at random proved on measurement to be those of the β-modification.

Commercial *p*-nitrophenol consists of a mixture of both kinds of crystals, and on examination it will generally be found that some are red whilst others are not. The former are those of the β-modification.

Cases of colour change have previously been observed, but as far as the author is aware, no case has previously been discovered in which the change is restricted to one crystalline modification. At present the usually accepted view with regard to polymorphous modifications is that the difference in crystalline form is not due to a difference in the chemical molecule, but rather in the different mode of packing of the molecules. The above remarkable difference of behaviour, however, of the two "polymorphous" modifications of *p*-nitrophenol would seem to argue for a difference in chemical structure; it is difficult to see how a mere difference in the arrangement of the same chemical molecules should render one crystal structure immune to the action of actinic rays. It is therefore suggested that the chemical structures of the α- and β-modifications of *p*-nitrophenol are different.

167. "The sensitiveness of pentamminenitrosocobalt salts to light." By Oskar Krafft Heinrich Burger.

In purifying the red variety of pentamminenitrosocobalt nitrate (Sand and Genssler, *Ber.*, 1903, **36**, 2083; *Annalen*, 1903, **329**, 194) by crystallisation from water, it was noticed that the deep red solution is sensitive to light, and is slowly decomposed with the formation of nitric oxide and a green flocculent precipitate of cobaltous hydroxide. This decomposition cannot well be explained but by the assumption that the red salt changes under the influence of light into the black isomeride considered, by Sand and Genssler, to contain bivalent cobalt, and that the latter is then decomposed by the water. The reaction may be represented by the equation:

$$Co_2(N_2O_2)(NH_3)_{10}(NO_3)_4 + H_2O = Co(OH)_2 + 2NO + 4NH_4NO_3 + 6NH_3.$$

If the solution is kept acid during the decomposition, the same quantity of gas is developed, but no precipitate is formed, the cobalt remaining in solution as cobaltous salt.

A similar decomposition is observed when a solution of the red salt is heated for some time. The development of gas is the same, but instead of the green, flocculent hydroxide a more compact, black cobaltous oxide is formed. That the decomposition in light is really due to the rays of light, and not to those of heat, is shown conclusively by the fact that the more refrangible end of the spectrum only produces the reaction.

A determination of the solubility in water of the red nitrate showed that one part of the salt dissolves in about twenty-five parts of water. For the purpose of identifying the gas evolved in the reaction, a few c.c. of an acidified solution of the red nitrate were placed on top of the mercury in a eudiometer, and subjected for several hours to the action of direct sunlight. It was found advantageous to have the solution acidified, because otherwise the gas bubbles become attached to the flocculent precipitate, and do not separate easily. The acid merely serves to prevent the formation of cobaltous hydroxide, otherwise the reaction proceeds in exactly the same way. The slow liberation of gas was the only sign of the change taking place. No variation of colour could be observed, as the colour of the red cobaltic nitrate in solution is almost the same as that of a cobaltous salt. The gas evolved was proved to be nitric oxide.

The following short account of a series of experiments will give an idea of the velocity of the reaction. Four flat porcelain dishes of about 8 cm. diameter were charged with 10 c.c. each of a solution containing 1·620 grams of the red nitrate per 100 c.c.

They were all exposed at the same time to direct sunlight (the sun being close to the zenith), and successively withdrawn at intervals of five minutes. The precipitate formed was collected in the dark, the filtrate evaporated with sulphuric acid, and the cobalt sulphate weighed.

10 c.c. of the original solution contained			0·1620	gram	of nitrate.
10 c.c. contained after	5 minutes'	exposure	0·0988	,,	,,
,, ,, ,, ,,	10 ,,	,,	0·0828	,,	,,
,, ,, ,, ,,	15 ,,	,,	0·0704	,,	,,
,, ,, ,, ,,	20 ,,	,,	0·0698	,,	,,

It is evident that the reaction slows down as the solution becomes more dilute, and the soluble products of the reaction (ammonia and ammonium nitrate) accumulate in the solution.

The spectrum of the red solution shows only general absorption of the more refrangible part from the green onwards. As would be expected, only those rays that are absorbed will produce decomposition. Solutions of the red nitrate of equal strength were exposed to sunlight covered with red, yellow, green, and blue glasses respectively. After several days' exposure, the solution under the red and yellow glass did not show any sign of decomposition, that under the green filter only a slight one, whereas the solution under the blue glass was decomposed to a considerable extent.

It was suggested that the solution of the red nitrate might be used with advantage for the construction of a chemical photometer.

168. "Lecture experiment to illustrate dust explosions. The surface areas of certain finely-divided combustible solids." By William Robert Lang and Hoyes Lloyd.

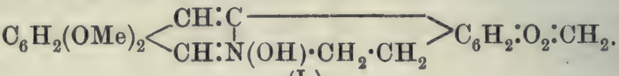
The following experiment serves as an illustration of the liability to explosion of the dust from starch and from coal when mixed with air. A glass cylinder, about seven feet long and four inches wide and open at both ends, is set up vertically, wires from an induction-coil being led through glass tubes into the middle of the chamber. Lycopodium, starch, and coal-dust, when allowed to fall into the tube and a spark passed through the mixture, ignite with explosive violence, the combustion being propagated throughout the length of the tube, and the flames issuing a considerable distance from either end. Direct application of a lighted taper produces the same result.

With the view of arriving at some approximate idea of the total surface of the combustible matter exposed to the air in such cases, the dimensions of the particles of the substances employed were ascertained by a microscopic examination, and the surface-area per 100 grams of each calculated. In like manner, "pyrophoric carbon" and pyrophoric iron were examined, and similar calculations made. The results may be summarised as follows:

Substance.	Mean diameter of particles in millimetres.	Total surface area for 100 grams of substance.
Lycopodium	0·028	20·92 square metres.
Maize starch	0·0122	32·78 ,, ,,
Coal dust: *a.* medium	0·012	33·33 ,, ,,
Coal dust: *b.* fine	0·0016	250·00 ,, ,,
"Pyrophoric carbon"	0·00125	332·00 ,, ,,
Pyrophoric iron	0·0054	15·08 ,, ,,

169. "The constitution of berberine." By Charles Kenneth Tinkler.

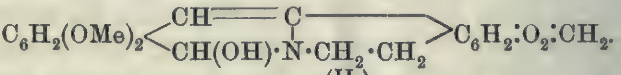
From an examination of the ultra-violet absorption spectra of berberine and its simple derivatives, evidence has been obtained of the existence of two modifications of the alkaloid in the solid state. Berberine crystallised from water gives spectra in aqueous, alcoholic, and also in chloroform solution, which are identical with those of the berberine salts, and from this agreement the substance would appear to have an ammonium-base constitution as represented by formula (I) (compare Perkin, *Trans.*, 1910, **97**, 321):



$$C_6H_2(OMe)_2{<}\begin{matrix}CH{:}C\text{———————} \\ CH{:}N(OH)\cdot CH_2\cdot CH_2\end{matrix}{>}C_6H_2{:}O_2{:}CH_2.$$

(I.)

A solution of the substance containing alkali, however, gives spectra which agree closely with those of Freund and Beck's methyldihydroberberine, and the same spectra are given by a chloroform and an ethereal solution of berberinal, the substance precipitated by the addition of sodium hydroxide to an aqueous solution of berberinium hydroxide. This agreement can only be explained by assigning to berberinal the carbinol formula (II), and the name *berberinol* is suggested for this substance:



$$C_6H_2(OMe)_2{<}\begin{matrix}CH{=\!=}C\text{———————} \\ CH(OH)\cdot N\cdot CH_2\cdot CH_2\end{matrix}{>}C_6H_2{:}O_2{:}CH_2.$$

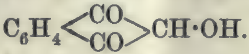
(II.)

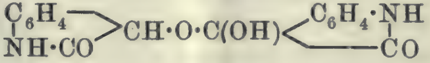
The transformation of berberinol into berberinium hydroxide is readily followed by means of the spectroscope.

Spectroscopic evidence was also obtained in support of the view that the products of decomposition of berberinol by excess of alkali are dihydroberberine and oxyberberine.

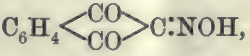
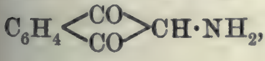
Since both modifications of the alkaloid can be obtained in solution in chloroform, it appears that both the ammonium base and the carbinol exist in the solid state. In this respect berberine differs from the other substances that have been investigated in connexion with the carbinol–ammonium base–aldehydeamine isomerism, in which cases evidence of the existence of the carbinol form alone in the solid state has been obtained.

170. "Triketohydrindene hydrate. Part IV. Hydrindantin and its analogues." By Siegfried Ruhemann.

Hydrindantin has been shown to yield a red solution with sodium carbonate and a blue solution with sodium hydroxide (*Trans.*, 1911, **99**, 792). An examination of these shows that the red salt is a salt of hydrindantin, and the blue sodium compound is a chromo-salt of the hydrolytic product of hydrindantin, namely, hydroxydiketohydrindene,  $C_6H_4{<}^{CO}_{CO}{>}CH\cdot OH$. This substance, which is to be regarded as the analogue of dialuric acid, could not be obtained pure, because it is readily oxidised to hydrindantin. Owing to the close resemblance of hydrindantin to alloxantin, the violet barium compound which this substance yields with baryta is to be regarded as a chromo-salt of dialuric acid, instead of alloxantin. The author also considers that isatide is an analogue of alloxantin, and that, therefore, it must be represented thus:



$$\begin{array}{c}C_6H_4\\|\\NH\cdot CO\end{array}{>}CH\cdot O\cdot C(OH){<}\begin{array}{c}C_6H_4\cdot NH\\|\\CO\end{array}$$

(compare Heller, *Ber.*, 1904, **37**, 946). Further, it was found that dialuric acid does not unite with triketohydrindene hydrate to form an analogue of alloxantin, but that the acid reduces the triketone to hydrindantin. This substance is also produced from oximinodiketohydrindene,  $C_6H_4{<}^{CO}_{CO}{>}C{:}NOH$, by means of concentrated hydriodic acid; on using stannous chloride, instead of hydriodic acid, the analogue of uramil, namely, diketohydrindamine,  $C_6H_4{<}^{CO}_{CO}{>}CH\cdot NH_2$, is formed.

171. "Aminoquercetin." (Preliminary note.) By Edwin Roy Watson.

An *aminoquercetin* has been obtained from quercetin by completely methylating to protect the molecule, nitrating, reducing, and demethylating.

Nitropentamethylquercetin, $C_{15}H_4O_2(OMe)_5{\cdot}NO_2$, prepared by dissolving pentamethylquercetin in cold nitric acid (D 1·4), crystallises from acetone in bright yellow, needle-shaped crystals, melting at 202—204°.

Aminopentamethylquercetin, $C_{15}H_4O_2(OMe)_5{\cdot}NH_2$, prepared by reducing the nitro-compound with tin and alcoholic hydrochloric acid, crystallises from benzene in almost white, stout prisms, melting at 200—202°. Its *hydrochloride* crystallises from dilute hydrochloric acid in white, needle-shaped crystals, and its *sulphate* from dilute sulphuric acid also in white, needle-shaped crystals. An *acetyl* derivative crystallises from alcohol and acetic acid in stout, white prisms, melting at about 223—226°.

Aminoquercetin, $C_{15}H_4O_2(OH)_5{\cdot}NH_2$, is obtained in solution as hydriodide on boiling either aminopentamethylquercetin or nitropentamethylquercetin with hydriodic acid (D 1·7). The free base is isolated in light yellow, needle-shaped crystals by decomposing its salts with pyridine and water. The *hydrochloride*,

$$C_{15}H_{11}O_7N,HCl,$$

crystallises from dilute hydrochloric acid in yellow, fine needle-shaped crystals, the *hydriodide* from dilute hydriodic acid in orange-coloured warts, and the *sulphate* from dilute sulphuric acid in yellowish-brown warts. An *acetyl* derivative, crystallising from alcohol and acetic acid in white rhombs, melting at 151—153°, is obtained by acetylation of either aminoquercetin or its salts; it is either the hexa- or the hepta-acetyl derivative.

Aminoquercetin dyes mordanted wool the following shades: brown on chrome, yellow-brown on alum, orange-red on tin, and brownish-black on iron. The shades are browner and deeper than corresponding dyeings with quercetin.

In the course of this investigation, the following quercetin derivatives have also been prepared:

Pentamethylquercetin hydrochloride, $C_{20}H_{20}O_7,HCl$, *hydrobromide*, $C_{20}H_{20}O_7,HBr$, *sulphate*, $C_{20}H_{20}O_7,H_2SO_4$, and *nitrate*, $C_{20}H_{20}O_7,HNO_3$. The first three of these oxonium salts are obtained in bright yellow, needle-shaped crystals on adding a concentrated solution of the corresponding acid to a solution of pentamethylquercetin in glacial acetic acid, and the nitrate is obtained, also in bright yellow needles, by adding concentrated nitric acid to a solution of pentamethylquercetin in absolute alcohol.

Trinitropentamethylquercetin, $C_{15}H_2O_2(OMe)_5(NO_2)_3$, prepared by dissolving pentamethylquercetin in cold fuming nitric acid, is a canary-yellow substance, melting at 190—205°.

Dibromopentamethylquercetin, $C_{15}H_3O_2Br_2(OMe)_5$, prepared by brominating pentamethylquercetin in glacial acetic acid solution, crystallises from alcohol or benzene in white, short prisms or leaflets arranged in sheaves, melting at 173—175°.

Dibromopentamethylquercetin hydrobromide, $C_{20}H_{18}O_7Br_2,HBr$, is obtained in bright yellow, needle-shaped crystals as an intermediate compound in the bromination of pentamethylquercetin.

Dibromonitropentamethylquercetin, $C_{15}H_2O_2Br_2(OMe)_5\cdot NO_2$, prepared by dissolving dibromopentamethylquercetin in cold nitric acid (D 1·4), crystallises from alcohol or acetone in light yellow rhombs, melting at 173—175°.

Pentamethylquercetindiazonium chloride, $C_{15}H_4O_2(OMe)_5\cdot N_2Cl$, is obtained in bright yellow, needle-shaped crystals on diazotising aminopentamethylquercetin hydrochloride.

Pentamethylquercetindiazonium sulphate separates in yellow, needle-shaped crystals on adding dilute sulphuric acid to a cold saturated aqueous solution of the corresponding diazonium chloride.

Pentamethylquercetinazo-β-naphthol,

$$C_{15}H_4O_2(OMe)_5\cdot N_2\cdot C_{10}H_6\cdot OH,$$

prepared by mixing an alkaline solution of β-naphthol and a solution of pentamethylquercetindiazonium chloride, crystallises from glacial acetic acid in deep crimson, needle-shaped crystals, melting and decomposing at 211°.

The amino-group in aminoquercetin is probably in the catechol nucleus in that position which is para- with respect to one of the hydroxyl groups and meta- to the other, but experiments are in hand to determine its position definitely. Experiments are also in progress to convert aminoquercetin into the corresponding hydroxyquercetin, and from the compounds now described to prepare other derivatives with dyeing properties.

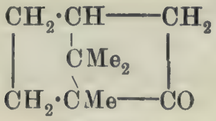
172. "The reduction of nitroacenaphthene." By Holland Crompton and Maggie Walker.

The methods suggested by Quincke (*Ber.*, 1888, **21**, 1454) and by Graebe (*Annalen*, 1903, **327**, 81) for the reduction of nitroacenaphthene are slow, and were not found to give good yields of aminoacenaphthene. Better results were obtained on using zinc dust and water as a reducing agent.

Nitroacenaphthene is mixed intimately with about five times its weight of zinc dust, and sufficient water is added to form a thin paste. The mixture is heated for ten hours on a water-bath, then dried at about 60°, and extracted with light petroleum. The aminoacenaphthene obtained on distilling off the solvent is slightly brown, owing to the presence of a small quantity of a brown-coloured by-product, which has not been further examined. It can be purified by treatment with dilute sulphuric acid. It is best to crystallise out the sulphate, as this salt is more stable on exposure to air than is the free base. The yield in the above process is about 60 per cent. of the theoretical.

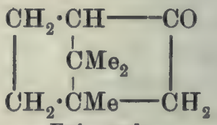
173. "Epicamphor: a new isomeride of camphor." (Preliminary note.) By Frederick Russell Lankshear and William Henry Perkin, jun.

Two keto-derivatives should be obtainable from camphane, namely:



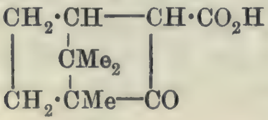
Camphor.

and

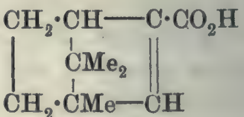


Epicamphor.

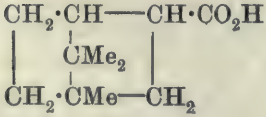
and of these the second, for which the name *epicamphor* is proposed, has not yet been described. Owing to the interest attaching to this substance, one of the authors has for some years attempted to prepare it, but, until recently, without success. It may be obtained by the following series of reactions. Camphorcarboxylic acid (I) is converted by reduction and subsequent elimination of water into bornylenecarboxylic acid (II), and the authors have observed that this acid is converted by reduction with palladium and hydrogen quantitatively into camphanecarboxylic acid (III) (compare Bredt, *Annalen*, 1909, **366**, 60). This saturated acid is readily brominated when its chloride is warmed with bromine on the steam-bath, and the bromo-ester obtained by pouring the bromo-acid chloride into alcohol is next digested with potassium acetate in acetic acid solution. After hydrolysis with alcoholic potassium hydroxide, the α-hydroxycamphanecarboxylic acid (IV) is oxidised by lead peroxide, permanganate, or also by chromic acid, and, in each case, small yields of epicamphor are obtained.



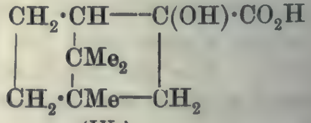
(I.)



(II.)



(III.)



(IV.)

Epicamphor is readily volatile in steam, has the same odour as camphor, and is remarkably like this substance in almost all its properties; it melts at about 165°, but this melting point, as well as the others mentioned in this paper, will be carefully revised when larger quantities of material are available.

Found: C=78·3; H=10·5. $C_{10}H_{16}O$ requires C=79·0; H=10·4 per cent.

Epicamphoroxime melts at about 102°, and has the same odour as camphoroxime, which melts at 119°. (Found, C=72·3; H=10·4; N=8·6. $C_{10}H_{17}ON$ requires C=71·8; H=10·2; N=8·4 per cent.) *Epicamphorsemicarbazone* separates from benzene in flocks and from methyl alcohol in glistening needles, and melts at 225—227° with effervescence, whereas camphorsemicarbazone melts at 236—238°. (Found, N=20·1. $C_{11}H_{19}ON_3$ requires N=20·1 per cent.)

The authors intend to prepare a number of derivatives of epicamphor with the object of comparing them with the corresponding derivatives of camphor.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Blücher, *H.* Modern industrial chemistry. Translated by *J. P.* **Millington.** pp. xvi + 779. ill. London 1911. (*Reference.*)
From the Publishers: The Gresham Publishing Company.

Edge, *John Harold.* Notes on practical cotton finishing. pp. 103. ill. London 1911. (*Recd.* 9/5/11.) From the Author.

Fowler, *Gilbert John.* An introduction to bacteriological and enzyme chemistry. pp. viii + 328. ill. London 1911. (*Recd.* 26/5/11.)
From the Author.

Körner, *Wilhelm.* Über die Bestimmung des chemischen Ortes bei den aromatischen Substanzen. (Ostwald's *Klassiker*, No. 174.) Leipzig 1910. (*Recd.* 30/5/11.) From the Author.

Ostwald, *Wilhelm.* Introduction to chemistry. Authorized translation by *William T.* **Hall** and *Robert S.* **Williams.** pp. ix + 368. ill. New York 1911. (*Recd.* 28/4/11.)
From the Publishers: Messrs. John Wiley and Sons.

II. *By Purchase.*

Bang, *Ivar.* Chemie und Biochemie der Lipoide. pp. xi + 187. Wiesbaden 1911. (*Recd.* 17/5/11.)

Hopkins, *Cyril George:* Soil fertility and permanent agriculture. pp. xxiii + 653. ill. Boston 1910. (*Recd.* 25/5/11.)

May, *Percy.* The chemistry of synthetic drugs. pp. xiii + 229. London 1911. (*Recd.* 25/5/11.)

Roberts-Austen, *Sir William Chandler.* An introduction to the study of metallurgy. 6th edition, revised and enlarged by *F. W.* **Harbord.** pp. xv + 478. ill. London 1910. (*Recd.* 25/5/11.)

Thiel, *A.* Der Stand der Indikatorenfrage. Zugleich ein Beitrag zur chemischen Theorie der Farbe. (Sammlung, Vol. XVI.) Stuttgart 1911.

Tutton, *Alfred Edwin Howard.* Crystallography and practical measurement. pp. xiv + 946. ill. London 1911. (*Recd.* 25/5/11.)

Wehmer, *C.* Die Pflanzenstoffe. Chemische Bestandteile und Zusammensetzung der einzelnen Pflanzenarten, Rohstoffe und Produkte. pp. xvi + 937. Jena 1911. (*Recd.* 17/5/11.)

Werner, *A.* New ideas on inorganic chemistry. Translated by *Edgar Percy* **Hedley.** pp. xvi + 268. London 1911. (*Recd.* 25/5/11.)

Zeitschrift für angewandte Chemie. General Register. Jahrgänge 1887 bis 1907. Edited by *Berthold* **Rassow** and *Ernst Wolfgang* **Müller.** pp. iv + 609. Leipzig 1910. (*Reference.*)

III. *Pamphlets.*

Autenrieth, *Wilhelm,* and **Tesdorpf,** *Theodor.* Über eine kolorimetrische Bestimmung des Traubenzuckers im Harn. (From the *Münch. med. Woch.*, 1910, **37**.)

Beck, *Karl,* and **Stegmüller,** *Ph.* Über die Löslichkeit von Bleisulfat und Bleichromat für sich, in Gemischen und in Form von Ölfarben in verdünnter Salzsäure, sowie über das Gleichgewicht von Chromat und Bichromat in Lösung. (From the *Arb. K. Gesundh.-Amt,* 1910, **34**.)

Calliess, *Franz Wilhelm.* Über Ephedrin und Pseudoephedrin. (From the *Apoth. Zeit.*, 1910, **25**.)

Clacher, *William.* Some notes on animal charcoal. (From the *Int. Sugar J.*, 1910.)

Comanducci, *Ezio.* Tallochinina. pp. 7. Napoli 1910.

Coventry, *Bernard.* Report on the progress of agriculture in India for 1909–10. pp. 106. Calcutta 1911.

Dibdin, *William Joseph.* Notes of lecture on mortar and cement. pp. 32. London 1911.

Fischel, *Richard.* Der histochemische Nachweis der Peroxydase. (From the *Wien. klin. Woch.*, 1910, **23.**)

Forssner, *Gunnar.* Über die Einwirkung des Nahrungsfettes auf die Acetonkörperausscheidung. (From the *Skand. Archiv. Physiol.*, 1910, **23.**)

Fouard, *Eugène.* L'état colloïdal de l'amidon et sa constitution physicochimique. pp. 147. Laval 1911.

Gaebel, *Gustav Otto.* Das Reischauersche Titrationsverfahren zur Bestimmung des Harnzuckers. (From the *Apoth. Zeit.*, 1910, **25.**)

Gazzetti, *C.*, and **Sarti,** *C.* Intorno ad una reazione rossa del reattivo di Esbach. (From the *Arch. farm. sperim. Sci.*, 1910, **9.**)

Gray, *George.* On the dissolved matter contained in rain water collected at Lincoln, New Zealand. (From the *Canterbury Agric. Coll. Mag.*, 1910).

Hämäläinen, *Juho.* Über das Schicksal des Cineols (Eukalyptols) im Organismus. (From the *Skand. Arch. Physiol.*, 1910, **24.**)

Hämäläinen, *Juho,* and **Sjöström,** *Lennart.* Über den Umfang der Glykuronsäurepaarung bei enzymimmunisierten Kaninchen. (From the *Skand. Arch. Physiol.*, 1910, **24.**)

Henderson, *Velyen E.* Hemmung der Wirkung chemischer Muskelreize durch Anelektrolyte. (From the *Zentr. Physiol.*, 1910, **24.**)

Javillier, *M.* Sur les silicotungstates de conicine, de spartéine et d'atropine. (From the *Bull. Sci. Pharm.*, 1910, **17.**)

Kinoshita, *Tosaku.* Über das Auftreten und die quantitative Bestimmung des Trimethylamins im menschlichen Harn. (From the *Zentr. Physiol.*, 1910, **24.**)

Lauder, *Alexander,* and **Fagan,** *T. W.* The variation in the composition of milk. Fifth annual report. pp. 42. Edinburgh 1911.

Loew, *Oscar.* Über die physiologische Rolle der Kalziumsalze. (From the *Münch. Med. Woch.* 1910.)

—— Über die Wirkung von Strontiumsalzen auf Algen. (From *Flora*, 1911, **102.**)

Loew, *Oscar,* and **Bokorny,** *Th.* Aktives Eiweiss und Tannin in Pflanzenzellen. (From *Flora*, 1911, **102.**)

Miculicich, *Miroslav.* Über den Einfluss von Elektrolyten und Anelektrolyten auf die Permeabilität der roten Blutkörperchen. (From the *Zentr. Physiol.*, 1910, **24.**)

Moreau, *B.* Analyse quantitative d'un mélange de sels, de recherche particulièrement difficile. (From the *Bull. Sci. Pharm.*, 1910.)

Pohl, *Julius.* Experimenteller Beitrag zum Oxalsäurestoffwechsel. (From the *Zeitsch. exp. Path.*, 1910, **8.**)

THE FARADAY LECTURE.

The Faraday Lecture, entitled, "The Fundamental Properties of the Elements," will be delivered by Professor Theodore W. Richards, of Harvard University, on Wednesday, June 14th, 1911, at 8 p.m.

The Lecture will be given, by the kind permission of the Managers, in the theatre of the Royal Institution, 21, Albemarle Street, W.

Admission will be by ticket only. Each Fellow of the Society is entitled to two tickets which may be obtained on application to the Assistant Secretary, Chemical Society, Burlington House, W.

At the next Ordinary Scientific Meeting on **Thursday, June 15th, 1911, at 8.30 p.m.**, there will be a ballot for the election of Fellows, and the following papers will be communicated:

"The alleged complexity of tellurium." By A. G. Vernon Harcourt and H. B. Baker.

"The purification and properties of acetic acid." By W. R. Bousfield and T. M. Lowry.

"Cupriglycollates." By S. U. Pickering.

"The solubility of carbon dioxide in beer." By A. Findlay and B. Shen.

"An addition to the Buchner funnel." By A. C. G. Egerton.

"Polymorphic phthalylhydrazides." By F. D. Chattaway and D. F. S. Wünsch.

"The decomposition of hydrazides and hydrazones by heat." By F. D. Chattaway, C. Cumming, and B. H. Wilsdon.

"Note on gum kino." By J. L. Simonsen.

"The action of ammonia and amines on 2-phenyl-1:3-benzoxazine-4-one." By A. W. Titherley and E. C. Hughes.

"Electromotive forces in alcohol. Part I. Concentration cells with electrodes reversible to chlorine ions." By A. Lapworth and J. R. Partington.

"Some oxidation products of the hydroxybenzoic acids. Part III." By A. G. Perkin.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, June 15th, 1911.

Atkins, Ernest Andrew,
71, East Hill, Wandsworth, S.W.

Pharmaceutical Chemist. Have had one year's experience as Student in Laboratory, and also have studied successfully for Minor and Major Pharmaceutical Qualifications. Am desirous of keeping up-to-date in my knowledge of pure Chemistry, more especially in its application to Pharmacy.

James D. Kettle.	*Alexander Scott.*
C. F. Baker.	*John W. Heath.*
C. Edwd. Sage.	*S. Bosworth.*

Atkinson, Norman Ernest,
Ash Cottage, Thornhill Lees, Dewsbury.

Works manager. Six years Portland Cement Works' Chemist. At present, Manager of Calcium Carbide Works.

Walter M. Gardner.	Walter F. Reid.
A. Battye Knaggs.	H. S. Raper.

Barker North.

Blackhurst, Arthur Owen,
"Downing," Broughton, Preston.

Agricultural Demonstrator. I am desirous of keeping in touch with chemical developments. National Diploma in Agriculture (N.D.A.). A first-class Certificate granted by the Board of Education in the Advanced Agricultural Chemistry Section of the Agricultural Science Examination. Research work on manurial residues of crops for the Potash Syndicate, and in Black Scab of Potatoes for the Board of Agriculture.

R. Henry Jones.	John Robinson.
Allan Baguley.	*Harold B. Dixon.*

Ch. Weizmann.

Bradshaw, George Arthur,

28, Raymond Street, Bury, Lancs.

Teacher of Chemistry. M.Sc. Degree in Chemistry, Victoria University of Manchester, 1908. 1908–9 Science Master, The College, Kilkenny, Ireland. Since 1909 Chemistry Master, the High School, West Leeds.

Harry Ingham.	Harold B. Dixon.
Geo. M. Norman.	E. C. Edgar.

Ch. Weizmann.

Cooke, Charles Ernest,

35, Sebert Road, Forest Gate, Essex.

Representative of Messrs. J. and R. Griffin, Ltd., Manufacturing Chemists, Kingsway, London. Studied Chemistry at Royal College of Science and at the Hartley University College, Southampton. In 1908 was Science Master at the Grammar School, Shoreham, Sussex.

Chas. W. Truelove.	M. O. Forster.
D. R. Boyd.	G. T. Morgan.

W. Godden.

Clarke, Arthur Frederick,

12, York Avenue, Gillingham, Kent.

Teacher and Lecturer at Gillingham Technical Institute. Desirous of coming in touch with current scientific literature.

R. C. Farmer.	H. R. Redman.
W. H. Gibson.	*Robert Robertson*

E. G. Couzens.

Cowling, Thomas,

Easingwold, Yorks.

Teacher. For three years Chemical Student, University College, Nottingham. Hold First-class Certificates in Advanced Chemistry from Board of Education. Interested in Chemical research.

Frederick Cowling.	A. H. Salway.
John Thomas Fox.	F. Tutin.

Harold Rogerson.

Datta, Ganesh,

Dera Ismail Khan, N.W.F.P., India.

Barrister-at-law and Advocate, Chief Court, Lyallpur. B.A. (Punjab Univ.); M.R.A.C. (Cirencester, England), etc. Graduated in Arts at the University of the Punjab, India, in 1904. Obtained Honours Diploma of Membership at the Royal Agricultural College, England, in April, 1909, after nearly three years' study. Subsequently studied science and practice of dairying at different institutions in England.

Am landowner, manager of my farms, and interested in promoting scientific agriculture.

E. F. Harrison.
P. D. Sabherwál.
Ruchi Ram Sahni.
Hari Prasad.
Puran Singh.

Demuth, Rudolph,
68, Salusbury Road, London, N.W.

Chemical Technologist. Studied at University of Marburg and Imperial Polytechnicum, Charlottenburg. I was engaged by the Cape Government in experimental work connected with Rinderpest epidemic, especially in regard to the production of chemical anti septics and disinfectants for use in connexion with that and other infectious diseases of cattle. I have also been engaged in Agricultural and Horticultural researches of a chemical nature. In the field of Hygiene I have worked and produced useful apparati—now universally in use, etc., etc.

Peter MacEwan.
Thos. Tyrer.
Alfred Gordon Salamon.
J. Lewkowitsch.
George T. Holloway.

Gardner, Edgar Harold,
34, Salisbury Avenue, Colchester.

Schoolmaster. Student of Chemistry with the idea of becoming a teacher of the subject. Inter. B.Sc. (Lond.). Engaged with Mr. Neville on Stereoisomeric research for some time.

H. A. D. Neville.
A. W. Nunn.
Will. T. Boone.
H. P. Wilson.
A. E. Barker.

Ghose, Joges Chandra,
Bhagalpur, Behar, India.

Professor of Chemistry, T.N.J. College, Bhagalpur. M.A. in Chemistry, Class II. ; worked for two years in the Presidency College Chemical Laboratory under Dr. P. C. Rây, D.Sc., Ph.D., and Mr. Cunningham, M.A., F.C.S., A.R.C.S.I. Lecturing on Chemistry for four years.

Atul Chandra Ganguli.
P. C. Rây.
Bidhu Bhushan Dutt.
Punchãnan Neogi.
Chuni Lal Bose.
Jatindranath Sen.

Gonville, Cyril Herbert Koszelski, F.R.B.S. (London),
"Milton," Queen's Road, Buckhurst Hill, or 63, The Broadway,
Stratford, Essex.

Colouring Specialist; Joint Inventor of a new chemical process for making Caramel. Technical Chemist. Have done considerable work both in the Study of Chemistry and its Practical Application in Manufacture. Worked out and invented an improved process for Caramel and also for priming Beers, etc. Studied Chemistry both privately and publicly, the latter at Sir John Cass' Institute, and the Chemistry of Brewing under Mr. Ling and under Dr. Harden for Micro-biology.

John Heron.
Charles A. Keane.
H. Burrows.
Arthur R. Ling.
Arthur Harden.
F. R. Holloman.

Goold, Rowland Lewis,
5, Corporation Street, Birmingham.

Registered Patent Agent (by Examination). Associate of the Institution of Electrical Engineers. I am a Patent Agent practising in the firm of Lewis Wm. Goold. In the department of my business relating to Chemical Science I have been engaged in the investigation of principles and analogies in the Chemistry of new manufactures tendered as subject for Letters Patent. I now have the responsible conduct of practically all the more important and more technical of the chemical and cognate matters with which my firm from time to time has to deal. I desire admission to the Society in order that I may follow more closely the progress of Chemical Science.

W. R. Bousfield.
T. Slater Price.
Douglas F. Twiss.
Arthur Colefax.
E. A. Tyler.

Joseph, Edward Lionel,
96, Victoria Street, S.W.

Managing Director of Ozonair, Limited. Consulting Engineer. Member of the Institution of Electrical Engineers. Inventor and Patentee of about 100 Inventions and Processes connected with Ozone in its various applications, etc., etc.

Leonard Temple Thorne.
W. H. Simmons.
William A. Tilden.
J. C. Cain.
W. Gordon Carey.

Linenbröker, Henry Edmund,
100, Harrow Road, Paddington.

Wholesale Chemical Manufacturer. Principal of "The Imperieux Laboratories." Intent to advance in Chemical Science. Author of "Blue Book Recipes on Scientific Colouring"; Author of "Das Brevier der Haarfarben Chemie." Contributor to various periodicals.

John T. Furnell.
Frank E. Weston.
William A. Colebourn.
W. H. Collier.
J. Cruickshank Smith.

Ling, Herbert James,
Hankow, China.

Chemist (Director Hankow Disp., Ltd.). Pharmacist. Investigations include Chinese Wood Oil, Chinese Bean Oil, Rhubarb, etc. Desirous of keeping in touch with modern research upon these subjects.

E. J. Millard. Thomas Tyler.
John C. Hewlett. *Peter MacEwan.*
H. H. Robins.

Merriman, Richard William,
244, Victoria Park Road, South Hackney.

Demonstrator in Chemistry, Guy's Hospital Medical School. M.A. Cambridge, Natural Science Tripos, Parts I and II. Joint Author with Dr. S. Ruhemann of (*a*) "The Action of Phenylpropiolyl Chloride on Ketonic Compounds" (*Trans.*, 1905, **87**, 1384); (*b*) "Tetrazoline. Part III" (*Trans.*, 1905, **87**, 1768). Joint Author with Dr. J. Wade of "The Correction of the Specific Gravity of Liquids for the Buoyancy of Air" (*Trans.*, 1909, **95**, 2174).

S. Ruhemann. J. T. Hewitt.
John Wade. F. G. Pope.
Horace Finnemore.

Paul, Felix Gabriel, M.R.A.S.E.,
No. 64, 38th Street, Rangoon, Burma.

Superintendent of Land Records, Burma; at present on leave in England. Calcutta University Entrance Examination; Clerkship Examination of Burma; Higher Survey Examination for the appointment of Land Records officers in Burma. Has experience in the investigation of Chemical Science, especially in connexion with agricultural and other lands in Burma, and the treatment and classification of soils as a Survey and Revenue assessment officer under the British Government for several years.

E. Towyn Jones. Clarence A. Seyler.
J. A. Hatfield. *E. A. Tyler.*
John Williams Bevan.

Pitt, Leonard Ison,
109, Abbott Road, Bromley, London, E.

Schoolmaster. Studied Science for four years at the East London College, and obtained First Class Hons. in Chemistry at the London B.Sc. Examination in Oct. '08. Science Master at Stamford School since May '09.

J. T. Hewitt. Clarence Smith.
F. G. Pope. A. D. Mitchell.
F. S. Long.

Walton, Willam Keighley,

"Beechwood," Upper Rushton Road, Thornbury, Bradford.

Analytical Chemist. Since 1903 with F. W. Richardson, F.I.C., City Analyst, Bradford, and West Riding County Analyst, Yorkshire, as chief assistant. Joint author of paper on "Analysis of Camphorated Oil for Camphor Substitutes," *Analyst*, 1908. Later as Research Chemist to Messrs. Richardson and Jaffé, Analysts, Bradford. Conjoint author with Mr. Richardson of paper on "Composition of Turkey Red Oil," shortly to be read.

F. W. Richardson. George H. Martin.
A. Jaffé. Geoffrey A. Bracewell.
Walter M. Gardner.

The following Certificate has been authorised by the Council for presentation to Ballot, under Bye-law I. (3).

Gallsworthy, Benjamin,

Thilawa, Rangoon.

Oil Refiner. At present Chief Refiner to the British Burma Petroleum Co.; previously Chemist to the Indo Burma Petroleum Co., Ltd., and for many years engaged in Chemical work in the Indian Leather Industries.

H. V. Mitchell. *J. T. Hewitt.*

R CLAY AND SONS, LTD., BRUNSWICK ST., STAMFORD ST., S E., AND BUNGAY, SUFFOLK.

[Issued 29/6/11]

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 389.

June 14th, 1911. Extra Meeting, Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair. This meeting was held in the Theatre of the Royal Institution, by kind permission of the Managers.

The PRESIDENT, in opening the proceedings, said: We are gathered together in this historic chamber to celebrate what has come to be one of the most important festivals in the Calendar of the Chemical Society, the delivery of the Faraday Lecture, the presentation of the Faraday Medal. The high significance of this meeting is most effectively realised if we call to mind the names of the illustrious men who have functioned as Faraday lecturers in the past. Dumas, Cannizzaro, Hofmann, Wurtz, Helmholtz, and Mendeléeff are those who have passed away leaving imperishable memories behind them. Lord Rayleigh, Professor Ostwald, and Professor Emil Fischer, we rejoice to think, still remain great captains of science militant here upon earth. To this distinguished line of Faraday lecturers the Chemical Society has now added another member in the person of Professor Richards, of Harvard, the eminent savant whom we are to have the pleasure and privilege of hearing to-night. Professor Richards requires no introduction from me; his work, his important contributions to science, especially his determination of atomic weights and his experiments on the compressibility of the elements, are not only well known in this country, but throughout the chemical world. I have great pleasure in calling upon Professor Richards to deliver the Faraday lecture.

Professor Richards then delivered the Faraday Lecture, of which the following account is an abstract: *

The fundamental properties of the elements.

The subject of my lecture to-night concerns the methods and general results of several extended series of investigations, planned with the hope of adding a little to the foundations of human knowledge by means of careful experiment.

Among all quantities worthy of exact measurement, the properties of the chemical elements are surely some of the most fundamental, because the elements are the vehicles of all the manifold phenomena within the range of our perception.

Weight is clearly one of the most significant of these properties. In the exact determination of atomic weights each portion of substance to be weighed must be free from the suspicion of containing unheeded impurities; otherwise its weight will mean little. Every substance must be assumed to be impure, every reaction must be assumed to be incomplete, every measurement must be assumed to contain error, until proof to the contrary can be obtained.

That the atomic weights may be connected by precise mathematical equations seems highly probable; but although many interesting attempts have been made to solve the problem, the exact nature of such relationships has not yet been discovered. It seems to me that the discovery of the ultimate generalisation is not likely to occur until many atomic weights have been determined with the utmost accuracy.

Volume also is important. About twelve years ago, on applying van der Waals' well-known equation to several gases, it seemed clear to me that the quantity b is not really a constant quantity, but is subject to change under the influence of both temperature and pressure. But if the quantity b (supposed to be dependent upon the space actually occupied by the molecules) is changeable, are not the molecules themselves compressible? If changes in the bulk of molecules are to be inferred even from gases, may not the expansion and contraction of solids and liquids afford a much better clue to the relative expansion and contraction of these molecules? Much evidence has been accumulated pointing toward a positive answer to these questions.

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* Full Report, *Trans.*, 1911, p. 1201.

The ordinary conception of a solid has always seemed to me little short of an absurdity. A gas may very properly be imagined with moving particles far apart, but what could give the rigidity of steel to such an unstable structure? The most reasonable conclusion, from all the evidence taken together, seems to be that the interstices between atoms in solids and liquids must usually be small, even in proportion to the size of the atoms themselves, if, indeed, there are any interstices at all. The kinetic theory of *gases* remains unmolested by these considerations, except as they indicate the changeability of b in the equation of van der Waals, but the new views affect seriously the application of this equation to solids and liquids.

The compressibilities of thirty-five elements and many simple compounds were studied with sufficient care to leave no doubt as to their relative values. It became at once manifest that the formation of a compound of a compressible element was attended with greater decrease of volume than the formation of a similar compound of a less compressible element, other things being equal.* This is just what the theory leads us to expect, and is a fact inexplicable by any other hypothesis as yet known to me.

Another essential aspect of the theory of compressible atoms is that which concerns cohesion. If the pressure of chemical affinity causes atomic compression, may not the pressure of cohesive affinity also have the same effect? The affinity which prevents solids and liquids from vaporising is generally admitted to produce great internal pressure; must it not tend to compress the molecules into smaller space? Molecules with high cohesive affinity (those of substances hard to volatilise) should be much compressed, and possess small volume, whereas molecules with a slight cohesive affinity should be more bulky. Moreover, those molecules already much compressed by their own self-affinity would naturally be but little affected by additional pressure.

Thus, as regards two substances otherwise similar, the less volatile one would be less compressible, denser, and possess greater surface tension. These outcomes of the theory correspond with the facts in a majority of cases thus far studied. Differences of structure and differences of chemical nature sometimes conceal these relations; the parallelism appears most strikingly among isomeric compounds. In brief, the bulk of evidence strongly indicates that cohesiveness, as well as chemical affinity, exerts pressure in its action, and hence that each plays a part in determining the volumes occupied by molecules.

Carried through to its logical conclusion, the idea that atoms are compressible gives one quite a new conception of the molecular mechanics of the universe. The influence of atomic compressibilities may be perceived everywhere, and in most cases each fact seems to fit easily and without constraint into its place in the hypothesis. Even apparent exceptions, such as the abnormal bulk of ice, may be ascribed in a reasonable fashion to superimposed effects.

The more closely the actual data are studied, the more plausible the hypothesis of compressible atoms appears. Ten years' experience with its interpretations leads me to feel that the idea is highly suggestive and helpful in stimulating new search after truth and in correlating and codifying diverse facts. By such fruits are hypotheses justified.

Chemical energetics being involved in the consideration of these relations, I sought to improve the technique of thermochemistry. The new method of adiabatic calorimetry was devised, and with it interesting results have been obtained.

All these and other properties of the elements are to be compared with each other quantitatively. New evidence is at hand showing that they do not all vary with the same periodicity as the atomic weights increase. The solution of the cosmic riddle is of the greatest importance to humanity, because only through a complete understanding of his own structure and that of his environment can man obtain control of the necessary conditions of his existence. The outlook is full of hope for the future.

In presenting the Faraday Medal to Professor Richards at the conclusion of the lecture, the PRESIDENT said: Professor Richards,—It is now my pleasant duty, in the name of the Chemical Society, to present you with the Faraday Medal, which bears the effigy of the Master, and which has been struck expressly for this occasion. It is the highest honour which this Society has to confer. In making this presentation I desire to assure you of the sincere appreciation and the deep regard which your colleagues in this country have for your work, and also of the great and enduring importance which we attribute to your scientific discoveries.

Professor ODLING, in proposing a vote of thanks to the lecturer, said: Mr. President, Ladies and Gentlemen,—Some two or three days ago I was highly gratified by being invited to be present by the President, the distinguished son of a distinguished father, to undertake the duty of proposing a vote of thanks to the lecturer. But this gratification, I find now, is sadly marred by the sense of my utter incompetence to express in fitting terms our appreciation for the intellectual treat which has been put before us. At the same time there is, perhaps, a certain inferior fitness in this duty being assigned to me in consideration of my connexion with

Professor Faraday, as being for a time his successor in this institution, and with the Chemical Society, by which the lectureship has been instituted. At the present time the Fullerian professorship is occupied by Sir James Dewar, who is unfortunately not able to be present with us on this occasion, and whose personal exertions have added so much to the reputation of this professorship. In the time between his acceptance of the professorship and his assumption of office, the professorship was held by myself and by Dr. Gladstone, and this particularly, therefore, brings us into association with the Royal Institution. With regard to the Chemical Society I am perhaps entitled to speak on its behalf in a double capacity, in that I am at the present time the senior Fellow of the Society, and that the institution of this lectureship was carried out at my personal proposition, and, in some measure, I venture to say, through my personal activity, because, although the proposition met with hearty goodwill, there were some technical difficulties which required to be smoothed over. As the oldest member of the Chemical Society, I may venture to remind you that I was elected in the presidency of Professor Brande, a long time the secretary of the Royal Society and the favourite pupil of Sir Humphry Davy, and the successor of Sir Humphry Davy in his professorship of the Royal Institution, he himself being subsequently succeeded by Faraday. On the institution of this lectureship we were fortunate in securing Dumas as our first lecturer. It was thereby at once recognised that a very high standard of proficiency had been established for the lecturers who would follow him. That standard has been thoroughly well kept up by Professor Richards, to whose admirable and searching address we have listened with so much interest. For myself I would venture to say that I do not feel at all shocked by his proposition as to the absolute continuity of matter in the solid and liquid states. On the occasion of the first Faraday lecture, Dumas enlarged on the absolute unresolvability of what we called the chemical elements, as they were then known. He pointed out that those forms of matter had existed unchanged for millions of years, and suggested that they were likely to remain unchanged for millions of years to come, a suggestion which I would recommend with all deference to Sir William Ramsay. Our present lecturer, Professor Richards, has, we shall all agree, more than attained the high standard which was originally set up. I had the pleasure of hearing Professor Richards at Oxford a few days ago, and I was much struck by his expression of hopefulness for the future, that there should be no resting places in chemistry, and that the work should go on for ever. If we look back to the time of the institution of the Chemical

Society, some seventy years ago, I think we may say there has been no decade in which fundamental points of importance in the way of discovery and interpretation have been lacking, and neither has continuity failed. On the occasion to which I have referred, Professor Richards enlarged on the fact that, so far from having passed the grand age of chemistry, we were really after all only at the beginning. That is the feeling which must animate all of us. When the Faraday Lectureship was instituted, it was with the two-fold object of doing honour to Faraday, and of enabling the Fellows of the Chemical Society to meet and hear the views of the most eminent men among foreign professors. That Professor Richards possesses the qualification of eminence goes without saying, but that he possesses the qualifications of being a foreigner may be very much doubted. Here we do not recognise the citizens of the United States, and more particularly the scientific men of the United States, with many of whom it has been my advantage to be associated, as being in any way foreigners. We are pleased to greet them, and Professor Richards is one of ourselves. At the present moment we have the professors of chemistry at Harvard and Yale on our list of Honorary Fellows, and a number of other illustrious citizens of the United States whom we are proud to consider as being part and parcel of ourselves.

Sir William Tilden: Mr. President, Ladies, and Gentlemen,—I rise very willingly to second the resolution which has been laid before the meeting by our senior Fellow. But, as might be expected when you think that Dr. Odling was asked to move the resolution, you will see that he has exhausted the subject. However, I, too, have enjoyed the privilege of being present on a good many occasions when the Faraday Lectures have been given in this room, and, though, of course, I was very young at the time, I quite distinctly remember the magnificent discourse given by Dumas. I remember also that, in his peroration, he seemed to indicate that there was some sort of limit set, either by human capacity or in some other way, to the possibilities of science, but if he had lived, as we have had the advantage of doing, down to the beginning of the twentieth century, he would no doubt have changed that opinion fundamentally. However, Professor Dumas was, at the time of the Faraday lecture in 1869, almost at the end of his career, and he did not live many years after that. Our Faraday Lecturer to-night has led us to look forward with a hopeful feeling to the development of new ideas in chemistry and physics. He is still a young man, and, as we hope, not half-way through his magnificent career. In seconding the vote of thanks, I should be glad to be allowed to express in your name our most cordial wishes for the continuance of his good health, good spirits, and strength, to carry on those laborious experiments with which we are all familiar on this side of the Atlantic. In listening to his discourse, it was with a feeling of mingled relief and disappointment that I found he was talking about the fundamental properties of the elements without having given us the definition of an element. I gathered with some satisfaction that he was really referring to the old-fashioned elements which were talked of by Dalton and others, and which are referred to in the well-known classification of the elements in the periodic table. For my part, I am afraid I am too old to learn the new sort of chemistry which seems to be coming up, but I do feel very strongly that we are not likely to part with our old friends the Daltonian elements—whether they are preserved or not I do not care—so long as the wonderful development of stereochemistry in the last few years continues to be evolved. It seems to me that the whole of stereochemistry is the fundamental argument in favour of the stability of atoms in chemical combination. However, this is not the time, nor am I the person, to present these views to you. I should like to be allowed to support the proposal which has been laid before you so eloquently and in so interesting a manner by Dr. Odling, that we should return to our cousin from the other side of the Atlantic our most cordial thanks for the brilliant and admirable discourse which he has given us to-night.

Professor Dixon: Mr. President, Ladies, and Gentlemen,—On looking back at my late tenure of the office of President, which you, Sir, I think, have defined as two years' hard labour, I know there is one pleasurable duty which more than made amends for all the routine duties which fell to my lot in that position, and that was the privilege of conveying the invitation of this Society to the Faraday Lecturer of to-night. The Chemical Society looks high, and it expects much. Professor Richards has more than fulfilled those expectations. We have listened to-night to a story that is more entrancing than any fairy tale, because as we followed the flight of the lecturer's imagination we knew that that flight was surely guided and controlled by a man who had measured and weighed the elements with an accuracy hitherto unknown. Concerning the weighing of the elements, our old European ideas of finality have been overthrown by Professor Richards and his school, and we are at this moment seeing the fulfilment of the prophecy of Canning when he said, "I look to the new world to redress the balance of the old."

The Chairman having put the vote to the meeting, it was carried with acclamation.

Professor Richards: Mr. President, Ladies, and Gentlemen,—I can hardly find words to express my very deep and heartfelt appreciation, first, of the great honour, the extraordinarily high honour, which the Chemical Society has conferred upon me by inviting me to give this lecture and by awarding me this famous Medal, and, secondly, by the most kind expressions of opinion and of good feeling which I have heard here to-night. I shall treasure this Medal always, as a token of your kindness, and I shall, whenever I look at it, think of this memorable evening in this memorable building, where not only the great Faraday, but so many great men, have laboured and lectured.

Thursday, June 15th, 1911, at 8.30 p.m., Professor Percy F. Frankland, LL.D., F.R.S., President, in the Chair.

Messrs. William Gidley Emmett, J. T. M. Dunlop, and A. W. Titherley were formally admitted Fellows of the Society.

The President stated that the Council, at their meeting held that afternoon, had sealed an Address of Congratulation to His Majesty King George V. on the occasion of his Coronation, and an Address of Congratulation to the University of St. Andrews on the Celebration of the Five Hundredth Anniversary of the Foundation of that University.

To His Most Gracious Majesty King George V.

May it please Your Majesty,

We, the President, Council, and Fellows of the Chemical Society beg leave to offer to your Majesty our sincere and most respectful congratulations on the auspicious event of your Coronation.

We approach you with the more confidence when we remember how much the science of Chemistry and the position of our Society are indebted to the favours of your august House. We ever bear in mind that a Royal Charter was granted to the Chemical Society by Queen Victoria, and that the Royal College of Chemistry, which was so largely instrumental in fostering and developing the study of our science in this country, was founded by your illustrious Grandfather, the late Prince Consort. It is, moreover, with special gratitude that we recall the lively interest which, as recently as two years ago, was taken by your Majesty and Her Majesty Queen Mary in the International Congress of Applied Chemistry, when you extended the Royal welcome to the chemists of all nations assembled in the Capital.

We venture to hope that not only chemical research, but the pursuit of all useful knowledge, may be promoted and furthered in this realm under your benevolent and gracious patronage, and we beg to assure Your Majesty of our loyal devotion as we do earnestly hope and pray that Your Majesty's reign may be long, happy, and fruitful.

Signed on behalf of the Chemical Society,

(*Signed*) PERCY F. FRANKLAND, *President.*
„ ALEXANDER SCOTT, *Treasurer.*
„ ARTHUR W. CROSSLEY } *Honorary*
„ G. T. MORGAN } *Secretaries.*
„ HORACE T. BROWN, *Foreign Secretary.*

Dated this the Fifteenth Day of June, One Thousand Nine Hundred and Eleven.

TO THE UNIVERSITY OF ST. ANDREWS.

On the auspicious event of the Celebration of the Five Hundredth Anniversary of the Foundation of your University, we, on behalf of the Chemical Society, desire to offer you our most sincere and hearty congratulations.

We share the world-wide interest which is evoked by the oldest and most picturesque of the Scottish Universities, and we rejoice to think that this ancient seat of knowledge should have so early recognised the claims of natural science as to establish a Chair of Chemistry already one hundred years ago.

We congratulate you on your not having allowed the venerable traditions of the past to overshadow the urgent needs of the present, and we cordially admire the munificent and devoted generosity of your friends in raising the worthy buildings, equipped on modern lines, for the study of Chemistry.

It is, moreover, with lively satisfaction that we have come to regard your Chemical School as an active and fertile centre of research, in which have been conducted a large number of valuable investigations, the results of which are embodied in the *Transactions* of our Society.

We trust that the now happily accomplished absorption of the Dundee College by the University may prove of great mutual benefit, and that the blending of the young institution with the old may be a guarantee of continued strength and fertility.

In the name of the Council and Fellows of the Chemical Society we wish you all prosperity in the future, and we would express the earnest hope that the grey Town set by the Northern Sea may never cease to attract and inspire active workers, not only in our own science, but also in other branches of learning.

Signed on behalf of the Chemical Society,
(*Signed*) PERCY F. FRANKLAND, *President.*
„ ALEXANDER SCOTT, *Treasurer.*
„ ARTHUR W. CROSSLEY } *Honorary*
„ G. T. MORGAN } *Secretaries.*
„ HORACE T. BROWN, *Foreign Secretary.*

Dated this the Fifteenth Day of June, One Thousand Nine Hundred and Eleven.

The PRESIDENT announced that the Secretary of State had intimated his intention of making Regulations dealing with the smelting of materials containing lead, the manufacture of red or orange lead, and the manufacture of flaked litharge, in accordance with a draft, copies of which may be obtained on application to the Factory Department, Home Office, London.

Certificates were read for the first time in favour of Messrs.:
Lionel Gowing-Scopes, 3, Estcourt Street, Devizes.
George Wishart, B.A., Royal School, Armagh.

A ballot for the election of Fellows was held, and the following were declared subsequently duly elected:

Ernest Andrew Atkins.
Norman Ernest Atkinson.
Arthur Owen Blackhurst.
George Arthur Bradshaw, M.Sc.
Arthur Frederick Clarke.
Charles Ernest Cooke.
Thomas Cowling.
Ganesh Datta, B.A.
Rudolph Demuth.
Benjamin Gallsworthy.
Edgar Harold Gardner.
Joges Chandra Ghose, M.A.
Cyril Herbert Koszelski Gonville.
Rowland Lewis Goold.
Edward Lionel Joseph.
Henry Edmund Linenbröker.
Herbert James Ling.
Richard William Merriman, M.A.
Felix Gabriel Paul.
Leonard Ison Pitt, B.Sc.
William Keighley Walton.

Of the following papers, those marked * were read:

*174. "The alleged complexity of tellurium."

By Augustus George Vernon Harcourt and Herbert Brereton Baker.

It has been asserted by Flint (*Amer. J. Sci.*, 1910, [iv], **30**, 209) that tellurium can be separated into two fractions by partial precipitation of the tetrachloride by water.

Using 200 grams of highly purified telluric acid, the authors have repeated the work. After four partial precipitations, Flint obtained a diminution of a whole unit in the atomic weight of tellurium, but the authors find that the atomic weight is not altered. The mean result of five determinations of the atomic weight of the fourth fractionation was 127·54, that of material similarly purified, but without the fractional precipitation, being 127·53. They conclude that no separation is effected by this method, and that it is probable that Flint's material was insufficiently purified.

DISCUSSION.

Prof. ERNST COHEN said that he was extremely interested in the facts communicated by Dr. Baker, as they cleared up several doubtful points in some researches on the allotropy of tellurium which had been carried out during the last two years in his (the speaker's) laboratory.

It had been known for a long time that allotropic forms of tellurium existed, but we had been entirely ignorant of the relations between them and of the conditions under which they could be formed. The measurements of Exner, Berthelot, Beljankin, and others in this direction did not agree with each other, but an explanation of this disagreement was found in the fact that the allotropic change of one of these forms was markedly affected by light, which displaced the equilibrium.

Flint's recent statements introduced difficulties which the authors had now removed, as they had shown that tellurium must still be regarded as a single elementary substance. It was thus possible to bring all these phenomena, which appeared so mysterious, under the head of dynamical allotropy.

*175. "The purification and properties of acetic acid."

By William Robert Bousfield and Thomas Martin Lowry.

Acetic acid may be purified by distilling from potassium permanganate, using a still-head to retain acids of higher boiling point, and then freezing to remove the water. The purified acid melts at 16·60°, and has a density of 1·05148 at 18°/4°, and 1·04922 at 20°/4°; its maximum conductivity when mixed with water is $\kappa_{18} = 0·001641_5$.

DISCUSSION.

Dr. **VELEY** remarked that those workers who had been engaged in the purification of even the commonest acids could fully appreciate the difficulties encountered in preparing acetic acid free from its homologues, so as to obtain trustworthy data for its physical constants, such as electrical conductivity, melting point, and density.

The method adopted for destroying the formic acid by oxidation with potassium permanganate appeared to be of especial interest, as doubts had been expressed as to the statements contained in text-books that formic acid can be completely oxidised under these conditions.

Dr. **WADE** said that in purifying acetic acid for the preparation of esters he had succeeded in eliminating propionic acid and its immediate homologues by fractional distillation with a small quantity of water, with which it was perhaps not generally known that all the lower fatty acids, with the exception of acetic acid, formed volatile azeotropic mixtures. He employed, however, an evaporator still-head, which, as Young had shown (*Trans.*, 1899, **75**, 699), was much more efficient than the pear column employed by the authors. He doubted whether the oxidisable impurity observed by the authors was formic acid; it was well known that other oxidisable impurities were often present in commercial acetic acid.

Dr. L. F. **GUTTMANN** stated that in the course of some experimental work on mixtures of acetic acid and acetic anhydride he had had occasion to prepare pure acetic acid.

On attempting to do so by freezing a large quantity of "purest" glacial acetic acid, allowing it to thaw partially, discarding the liquid portions, and repeating this procedure five or six times, he had expected to obtain a glacial acetic acid of a high degree of purity: the analysis of this acid, however, gave over 100 per cent.

The normal solutions used were most carefully standardised, yet the result remained the same. Pure acetic acid, giving a value of 100 per cent., was subsequently obtained by fractional distillation of the products; it therefore appeared as if pure commercial acetic acid might contain some acetic anhydride which could not be removed by fractional crystallisation.

He wished to know whether the authors had had similar experiences.

Dr. **TITHERLEY** pointed out that the reducing substance supposed to be formic acid might be glyoxylic acid, which was a common impurity in acetic acid, and which would probably pass over in the earlier fractions on distillation. As glyoxylic acid in small quantities would account for the observations of the authors, he asked if any attempts had been made to prove the presence or absence of this substance.

Dr. Lowry, in reply, said that the acetic acid was distilled in presence of a little water, but the quantity was not sufficient to carry over the higher homologues before the acetic acid as a minimum boiling mixture.

The permanganate method of purification had the advantage that there was no real risk of producing any acetic anhydride; the acid was distilled while still moist, and was subsequently dried by freezing.

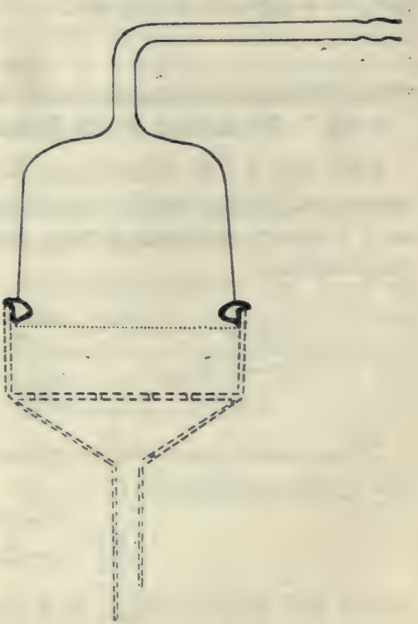
The oxidisable impurity of low boiling point might contain glyoxylic acid, but the object was to get rid of it, and not to identify or isolate it.

*176. "The solubility of carbon dioxide in beer."
By Alexander Findlay and Bucchok Shen.

Previous experiments on the absorption of carbon dioxide by beer (Langer and Schultze, *Zeitsch. für das ges. Brauwesen*, 1879, **2**, 369) have been interpreted as showing that beer dissolves more carbon dioxide than the corresponding water-alcohol solution; and the supposed increase has been attributed to adsorption by the colloids present in beer (Emslander and Freundlich, *Zeitsch. physikal. Chem.*, 1904, **49**, 317). These conclusions, however, are not in harmony with experiments carried out by Findlay and Creighton (*Trans.*, 1910, **97**, 536), and the authors now show that carbon dioxide is, as a matter of fact, less soluble in beer than in the corresponding water-alcohol solution, and that the contrary conclusion reached by Langer and Schultze must be attributed to their having used beer supersaturated with carbon dioxide.

*177. "An addition to the Buchner funnel." By Alfred Charles Glyn Egerton.

The apparatus consists simply of a small glass hood, which can be connected to a drying tube. The glass hood is made of such a diameter that

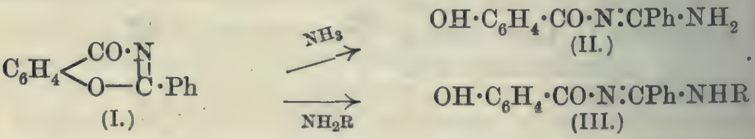


it fits inside a Buchner funnel, the joint being made air-tight with a rubber ring situated in a groove round the rim of the hood. It is well to employ a gentle pressure with the ring of a retort-stand to hold the hood in position, unless working with air under diminished pressure. A precipitate collected in the usual manner on the funnel can be dried by means of this simple additional apparatus in a very short time. Besides dispensing with the trouble of transferring the precipitate to a desiccator, the apparatus saves much time in the drying. The drying is most rapid when a steady, not too rapid, stream of air is drawn through the apparatus by means of the filter-pump after passing through a large drying tower filled with calcium chloride; further, the hood, which is made of blown glass or, for very rapid drying, of metal, can be warmed with a flame. The precipitate can, if desired, be dried under diminished pressure by affixing a screw clip to the air inlet of the drying tower. Another application of the apparatus is the drying of a precipitate in a non-reactive atmosphere; the gas can be circulated round and round, if necessary, by means of a blowing arrangement fitted to the filter-pump.

This small, inexpensive apparatus changes a Buchner funnel into an exceptionally efficient desiccator, which dries, not only precipitates collected on the funnel by the usual methods employed therewith, but also can be used conveniently for drying crucibles, etc., in a current of dry air.

*178. "The action of ammonia and amines on 2-phenyl-1:3-benzoxazine-4-one." By Arthur Walsh Titherley and Ernest Chislett Hughes.

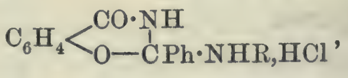
2-Phenyl-1 : 3-benzoxazine-4-one (I) readily combines with ammonia, giving bright orange needles of salicylbenzamidine (II), and primary amines, giving yellow derivatives (III) of similar constitution:



$$C_6H_4 < \begin{matrix} CO\cdot N \\ O\text{—}C\cdot Ph \end{matrix} \quad \text{(I.)} \qquad \xrightarrow{NH_3} \quad OH\cdot C_6H_4\cdot CO\cdot N{:}CPh\cdot NH_2 \quad \text{(II.)}$$

$$\xrightarrow[NH_2R]{} \quad OH\cdot C_6H_4\cdot CO\cdot N{:}CPh\cdot NHR \quad \text{(III.)}$$

These amidine derivatives give colourless hydrochlorides possessing the cyclic constitution:

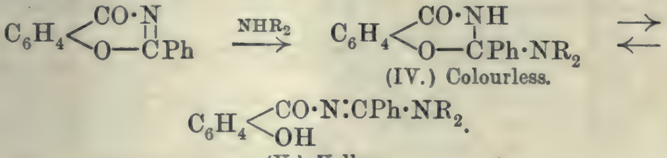


$$C_6H_4 < \begin{matrix} CO\cdot NH \\ O\text{—}CPh\cdot NHR,HCl \end{matrix},$$

which are very unstable, and readily lose ammonia or an amine, passing through the cyclic compound I into *N*-benzoylsalicylamide in presence of water. The free cyclic bases, which are intermediate compounds in the synthesis of the amidines II and III, are too unstable to exist in the free state.

Salicylbenzamidine (II) may also be synthesised from phenyl salicylate and benzamidine, and *o*-hydroxytriphenylcyanidine also results as a secondary product.

2-Phenyl-1 : 3-benzoxazine-4-one combines with secondary amines, giving mixtures of labile isomeric cyclic and open-chain compounds of the type IV and V:



$$C_6H_4\left<\begin{matrix}CO\cdot N\\ \quad \| \\ O{-}CPh\end{matrix}\right. \xrightarrow{NHR_2} C_6H_4\left<\begin{matrix}CO\cdot NH\\ \quad | \\ O{-}CPh\cdot NR_2\end{matrix}\right. \rightleftarrows$$

(IV.) Colourless.

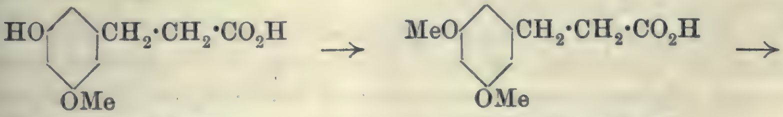
$$C_6H_4\left<\begin{matrix}CO\cdot N{:}CPh\cdot NR_2\\ OH\end{matrix}\right..$$

(V.) Yellow.

With dimethylamine no proper separation could be effected, but with diethylamine the colourless compound (IV) was isolated. With diphenylamine a bright yellow compound (V) was obtained, which, owing to steric influences, does not possess normal phenolic properties. It is probable that in all the yellow open-chain derivatives the molecule is bordering on ring-formation, and the colour is attributed to the disturbance of residual affinity thus created. Replacement of the hydrogen atom of the phenolic hydroxyl group by methyl in salicylbenzamidine leads to a colourless compound, the velocity of hydrolysis of which is normal as compared with similar amidines, whilst that of salicylbenzamidine and its derivatives is abnormally high owing to ring-formation.

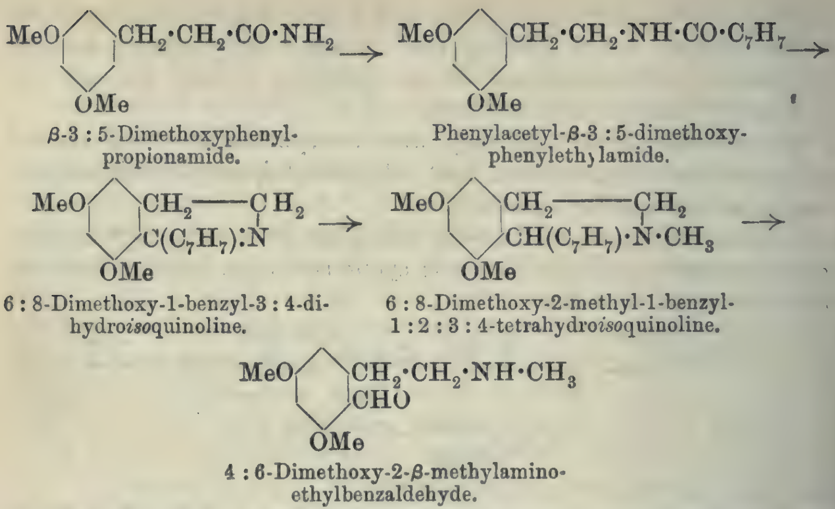
*179. "Synthesis of 4 : 6-dimethoxy-2-β-methylaminoethylbenzaldehyde." By Arthur Henry Salway.

4 : 6-Dimethoxy-2-β-methylaminoethylbenzaldehyde has been synthesised from β-5-hydroxy-3-methoxyphenylethylamine (*Trans.*, 1910, **97**, 2413) according to a series of reactions similar to those employed by the author in the synthesis of cotarnine (*Trans.*, 1910, **97**, 1208). The stages involved in this process are represented by the following scheme:



β-5-Hydroxy-3-methoxyphenylpropionic acid.

β-3 : 5-Dimethoxyphenylpropionic acid.



β-3 : 5-Dimethoxyphenylpropionamide.

Phenylacetyl-β-3 : 5-dimethoxyphenylethylamide.

6 : 8-Dimethoxy-1-benzyl-3 : 4-dihydro*iso*quinoline.

6 : 8-Dimethoxy-2-methyl-1-benzyl-1 : 2 : 3 : 4-tetrahydro*iso*quinoline.

4 : 6-Dimethoxy-2-β-methylaminoethylbenzaldehyde.

4 : 6-*Dimethoxy-2-β-methylaminoethylbenzaldehyde* closely resembles cotarnine in its physiological action on the isolated uterus. On the other hand, it is considerably less toxic than the latter compound.

DISCUSSION.

Dr. TITHERLEY inquired whether the author had instituted any experiments to determine which of the alternative tautomeric (open-chain or cyclic) formulæ represented the constitution of cotarnine and allied derivatives.

180. "Cupriglycollates." By Spencer Umfreville Pickering.

That the cupri-compounds formed by the action of alkalis on copper salts contain their copper in the form of CuO or CuOH, and not as metal displacing hydrogen atoms, has been shown by determinations of the molecular weights of six such compounds (*Trans.*, 1911, **99**, 169): more conclusive evidence has now been obtained by finding that in potassium cupriglycollate the ratio of Cu : K is 1 : 1, in accordance with the formula $CH_2O(CuOH)\cdot CO_2K$, and not 1 : 2, as it would have to be if the metal displaced hydrogen: $(CH_2O)_2Cu(CO_2K)_2$.

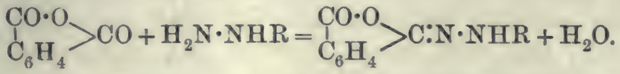
From a solution of copper glycollate mixed with excess of potassium hydroxide, alcohol precipitates a mauve-coloured, strongly alkaline, crystalline substance, which agrees in composition and properties with the γ-cupri-salts (containing the cuprite group) suggested as existing in such solutions. The corresponding salts of sodium and rubidium (probably, also, of barium) have been obtained, but not those of lithium, cæsium, or calcium. On heating, they seem, in some cases, to be transformed into compounds in which an atom of copper displaces two atoms of hydrogen in alcoholic hydroxyl groups.

181. "Polymorphic phthalylhydrazides." By Frederick Daniel Chattaway and Donald Frederick Sandys Wünsch.

Some years ago it was observed that phthalylphenylhydrazide, when crystallised from any ordinary solvent, separates almost invariably in two modifications different both in crystalline form and in colour. Each modification could be obtained free from the other by altering the temperature at which crystallisation took place. While this work was in progress, Dunlap (*J. Amer. Chem. Soc.*, 1905, **27**, 1091) published an account of similar observations, and it was consequently discontinued.

The authors have recently again investigated the subject to ascertain if this property of crystallising in two forms is common to all phthalylhydrazides. So far, only one other instance has been found among the simple phthalyl derivatives studied, but it seems certain that this is due to the exact conditions necessary for the appearance of the second modification not having been realised, many other observations on related compounds, which will be communicated later, leading to the conclusion that it should be possible to obtain every phthalyl and substituted phthalyl hydrazide in two forms.

A large number of phthalylhydrazides were described. These compounds are very easily obtained by heating together phthalic anhydride and the corresponding hydrazine; the reaction which occurs may be formulated thus:



$$\begin{matrix}CO\cdot O\\ | \\ C_6H_4\end{matrix}\!>CO + H_2N\cdot NHR = \begin{matrix}CO\cdot O\\ | \\ C_6H_4\end{matrix}\!>C\colon N\cdot NHR + H_2O.$$

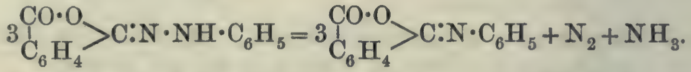
The crystals separating at the higher temperature are bright yellow or orange, those into which they pass when the temperature is lowered being almost colourless.

In every case where only one modification has been observed, it is the one having the deep orange colour.

182. "Decomposition of hydrazides and hydrazones by heat." By Frederick Daniel Chattaway, Charles Linaeus Cumming, and Bernard Howell Wilsdon.

In continuation of an investigation into the action of heat on hydrazines, the reactions which take place when various hydrazides and hydrazones are heated have been studied.

When the phthalylhydrazides are heated, vigorous reaction, accompanied by the evolution of heat, sets in at a definite temperature, nitrogen and ammonia are liberated, and a phthalanil is produced; for example:



$$3\left.\begin{array}{l}CO\cdot O\\ \,|\\ C_6H_4\end{array}\right>C:N\cdot NH\cdot C_6H_5 = 3\left.\begin{array}{l}CO\cdot O\\ \,|\\ C_6H_4\end{array}\right>C:N\cdot C_6H_5 + N_2 + NH_3.$$

In the case of hydrazones two main reactions take place, resulting in the formation of an unsaturated hydrocarbon, nitrogen, and a saturated hydrocarbon; thus, for example:

$$2C_6H_5\cdot CH:N\cdot NH\cdot C_6H_5 = C_6H_5\cdot CH:CH\cdot C_6H_5 + N_2 + 2C_6H_6,$$

or in the formation of an aldehyde-anilide, nitrogen, and ammonia, thus:

$$3C_6H_5\cdot CH:N\cdot NH\cdot C_6H_5 = 3C_6H_5\cdot CH:N\cdot C_6H_5 + N_2 + NH_3,$$

a somewhat larger amount of the hydrazone, as a rule, undergoing the latter decomposition. It seems highly probable that the so-called β-phthalylphenylhydrazide, melting at 210°, is really impure phthalanil produced from the ordinary or α-phthalylphenylhydrazide by the above-described decomposition.

183. "Some reactions of gum kino." By John Lionel Simonsen.

The author described some experiments on the constituents of the gum of *Pterocarpus Marsupium*.

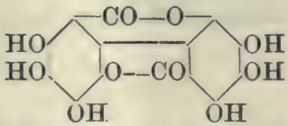
184. "Electromotive forces in alcohol. Part I. Concentration cells with electrodes reversible to chlorine ions." By Arthur Lapworth and James Riddick Partington.

Fairly satisfactory results may be obtained with such cells, containing alcoholic hydrogen chloride, with electrodes of silver or mercury, and with silver chloride and mercurous chloride, respectively, as depolarisers.

The transport number of chloridion is found to be about 0·37, as contrasted with 0·16 in aqueous hydrochloric acid. It was shown that this is due to the hydrogen ion, as the transport numbers for the ions of most salts hitherto examined do not appear to be greatly affected by such a change of solvent.

185. "Some oxidation products of the hydroxybenzoic acids. Part III." By Arthur George Perkin.

The substance $C_{14}H_6O_{10}$, now termed *caeruleoellagic acid*, previously obtained by heating ellagic or flavellagic acid with sulphuric acid (*Proc.*, 1906, **22**, 114), can also be prepared by the action of arsenic acid on the sulphuric acid solutions of these compounds. The *acetyl* derivative $C_{14}O_{10}(C_2H_3O)_6$ melts at 330—332°, and is in reality colourless, and the *benzoyl* compound $C_{14}O_{10}(C_7H_5O)_6$ forms needles melting at 343—345°. By distillation with zinc dust, caeruleoellagic acid gives fluorene, and with boiling potassium hydroxide solution a substance $C_{12}H_{10}O_8$, which crystallises in prismatic needles, and is evidently an *octahydroxydiphenyl*, the *acetyl* derivative of which, $C_{12}H_2O_8(C_2H_3O)_8$, forms colourless needles, melting at 177—178°. Caeruleoellagic acid, to which the constitution:



is assigned, dyes mordanted fabrics similarly to flavellagic acid, but somewhat more strongly.

186. "The triazo-group. Part XIX. Nitrosoazides of dipentene, *d*-limonene, and *l*-limonene." By Martin Onslow Forster and Frederik Marinus van Gelderen.

Dipentene nitrosoazide, $C_{10}H_{15}(:NOH)\cdot N_3$, prepared from either the nitrosochloride or the nitrosate by the action of sodium azide in aqueous alcohol, crystallises from methyl alcohol in colourless plates, melting at 72—73°; alcoholic potash eliminates hydrazoic acid, producing *i*-carvoxime. i-*Triazodihydrocarvone*, $C_{10}H_{15}ON_3$, arising from the foregoing nitrosazide (its oxime) by the action of hot aqueous oxalic acid, is a colourless liquid, having a pleasant odour of peppermint; it boils at 81°/0·4 mm., and has D 1·0409/20°. The *semicarbazone* melts at 132—133°.

d-*Limonene nitrosoazide*, $C_{10}H_{15}(:NOH)\cdot N_3$, whether prepared from the α- or the β-nitrosochloride, melts at 52—53°, has $[\alpha]_D$ 6·5°, and is converted into *l*-carvoxime by the action of alcoholic potash. d-*Triazodihydrocarvone*, $C_{10}H_{15}ON_3$, produced when the nitrosoazide is heated with aqueous oxalic acid, boils at 93°/0·46 mm., has D 1·0487/20°, and $[\alpha]_D$ 88·49°; the *semicarbazone* melts at 220°.

l-*Limonene nitrosoazide*, $C_{10}H_{15}(:NOH)\cdot N_3$, melting at 52—53°, and having $[\alpha]_D$ −3°, gives *d*-carvoxime with alcoholic potash. l-*Triazodihydrocarvone*, $C_{10}H_{15}ON_3$, obtained by hydrolysis with oxalic acid, boils at 93—94°/0·48 mm., has D 1·0472/20°, and $[\alpha]_D$ −92·5°; the *semicarbazone* melts at 220°.

187. "The relation of the velocity of chlorination of aromatic compounds to constitution. Part I. Chlorination of anilides." By Kennedy Joseph Previté Orton and Harold King.

The speed of chlorination (formation of monochloro-derivatives) of a number of acylanilides has been measured in glacial acetic acid solution. It was shown that the rate of the reaction varies enormously with the character of the substituent in the benzene nucleus. The nature of the acyl groups has a comparatively subsidiary effect.

Naphthalides are chlorinated at a far greater rate than the anilides.

188. "Chlorination of acylanilides. Effect of the constitution of the acyl group on the proportion of the ortho- and para-derivatives." By Harold King and Kennedy Joseph Previté Orton.

The proportion of *o*- and *p*-chloro-derivatives produced in the chlorination of form-, propion-, stear-, and benz-anilide has been estimated. Comparison with acetanilide (Jones and Orton, *Trans.*, 1909, **95**, 1056) shows that the largest proportion of the *o*-chloro-derivative is formed in this case. Acetanilide yields 45, propionanilide 26, stearanilide 12, benzanilide 11, and formanilide 3 per cent. of the *o*-chloro-derivative.

189. "The influence of the alternating factor in certain series on the molecular volumes at the melting point." By Gervaise Le Bas.

An examination of the molecular volumes of the paraffins at the melting point shows that the volume differences for CH_2 alternate in value exactly as do the melting points in several homologous series.

By finding the number of H equivalents in each compound (since $C=4H$), that is, W, and dividing this into the volume at the melting point, V, the ratio V/W gives the volume of H in each compound.

The molecular volumes of the normal paraffins at various temperatures can be calculated by means of interpolation formulæ with two constants.

I.—*Table of Constants.*

Compound.	M.W.	*W.*	M.P.	d_T.
Nonane, C_9H_{20} …………	128	56	−51·0°	0·7330 (0°)
Decane, $C_{10}H_{22}$ …………	142	62	−32·0	0·7454 (0°)
Undecane, $C_{11}H_{24}$………	156	68	−26·5	0·7557 (0°)
Dodecane, $C_{12}H_{26}$ ………	170	74	−12·0	0·7730 (m. p.)
Tridecane, $C_{13}H_{28}$………	184	80	− 6·2	0·7755 (m. p.)

II.—*Constitutive Effects in the Volumes of Compounds at the Melting Points.*

Compound.	*W.*	*M.V.* m. p.	Δ.	Δ between odd No.'s.	Δ between even No.'s.	*V/W* (odd).	*V/W* (even).
C_9H_{20}……	56	165·67				2·957	—
$C_{10}H_{22}$ …	62	184·54	18·9 16·9	35·7		—	2·976
$C_{11}H_{24}$ …	68	201·4			35·4	2·962	—
$C_{12}H_{26}$ …	74	219·9	18·5 17·4	35·9		—	2·972
$C_{13}H_{28}$ …	80	237·3			35·5	2·966	—
$C_{14}H_{30}$ …	86	255·4	18·1 17·8	35·9		—	2·970
$C_{15}H_{32}$ …	92	273·2			35·8	2·970	—
$C_{16}H_{34}$ …	98	291·2	18·0 17·8	53·8		—	2·971
$C_{17}H_{36}$ …	104	309·0				2·971	

Study of the data shows that:

(1) The even members of the series show augmented values of V/W, and the odd members depressed values. This is in accord with the fact that the melting-point curves are different, the one for the odd members falling below that for the even members.

(2) The values of V/W for the even members diminish to a constant value, 2·970, and those for the odd members increase to the same constant value. Thus, again, there is correspondence between the melting-point and volume curves in that the double curves gradually approach each other as the series is ascended.

The conclusion is drawn that for both the volumes and the melting points the alternating factor always exerts a depressing effect on the compound with an odd number of carbon atoms, and an elevating one on the compound with an even number of carbon atoms. The alternating factor consequently similarly affects both physical properties.

190. "The elimination of bromine from phenyl *p*-methoxystyryl ketone dibromide." By Forsyth James Wilson and Alfred Archibald Boon.

The authors find that when phenyl *p*-methoxystyryl ketone dibromide is treated with propyl alcohol, *iso*butyl alcohol, benzyl alcohol, or acetic acid, one of the products is *phenyl bromo-p-methoxystyryl ketone*, $MeO\cdot C_6H_4\cdot CBr{:}CH\cdot COPh$ or

$MeO\cdot C_6H_4\cdot CH{:}CBr\cdot COPh$,

which melts at 93—94°.

When the dibromide is heated with *iso*propyl alcohol, *tert.*-butyl alcohol, acetone, or benzoin, the ketone is regenerated.

191. "Some new inorganic salts." By Thomas Vipond Barker.*

In continuation of previous work on the regular growths on each other of isomorphous crystals, the author has completed the investigation of the series of alkaline periodates by the inclusion of the lithium salt, which proves to be entirely different from the compound described (but not analysed) by Rammelsberg, so that it seems probable that his compound was an impure specimen of sodium periodate.

A further contribution to the list of isomorphous substances has been made by the preparation of two new double chromates of the general formula $R_2Mg(CrO_4)_2,6H_2O$, in which $R = Rb$ or Cs; these two salts prove to be strictly isomorphous with the corresponding ammonium salt prepared some sixty years ago by Murmann, and with the better known series of double sulphates.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Trinum Chymicum oder Drey Chymische Tractätlein. I. Fr. Vincentii Koffsky . . . Schöner und ausführlicher Bericht von der ersten Tinctur-Wurzzel des Steins der Weisen, *etc.* (pp. 1—21 only). Strassburg 1699. (*Reference.*) From Dr. A. Harden, F.R.S.

Trinum Chymicum secundum oder Drey Andere Chymische Tractätlein. I. Heinrici Khunrath . . . Philosophische Erklärung von und über dem geheimen äusserlichen sichtbaren Gludt und Flammen-Feur der uhralten Magorum oder Weysen und anderer wahren Philosophen. II. Ein fůrtreffliches Judicium und Bericht eines erfahrnen Cabalisten, über die vier Figuren dess grossen Amphitheatri D. Henrici Khunrathi. III. Von der Tinctur Antimonii und Oleo Stibii von Theophrasto Paracelso Auch einem

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* This paper was communicated at the Meeting on June 1st.

Anhang zu der Materi dienlichen Sachen Von Basilio Valentino beschrieben. pp. [viii] + 174 (misprint for 184). Strasburg 1700. (*Reference.* From Dr. A. Harden, F.R.S.

Valentinus, *Basilius.* His last Will and Testament . . . , wherein he . . . declareth the wayes he wrought to obtain the Philosophers Stone, *etc.* London 1657—56. (9 parts, each having separate title-page. Wanting first title-page, and pp. 21 to 23 of a "Treatise concerning Microcosme.") (*Reference.*) From Dr. A. Harden, F.R.S.

II. *By Purchase.*

Nikaido, *Y.* Beet-sugar making and its chemical control. pp. xii + 354. ill. Easton, Pa. 1909. (*Recd.* 14/6/11.)

III. *Pamphlets.*

Pusa Agricultural Research Institute and College. Report 1909–10. pp. 69. Calcutta 1910.

Schrauth, *Walther,* und **Schoeller,** *Walter.* Über die Desinfektionskraft komplexer organischer Quecksilberverbindungen. I. Aromatischer Quecksilbercarbonsäuren. (From the *Zeitsch. Hyg. Infect.,* 1910, **66.**)

Stoddart, *Frederick Wallis.* Nitrification and the absorption theory. An account of the principles of the modern sewage filter. pp. 24. Bristol 1911.

Thunberg, *Torsten.* Studien über die Beeinflussung des Gasaustausches des überlebenden Froschmuskels durch verschiedene Stoffe. IV—IX. (From the *Skand. Arch. Physiol.,* 1910, **24.**)

—— Untersuchungen über autoxydable Substanzen und autoxydable Systeme von physiologischem Interesse. I. and II. (From the *Skand. Archiv. Physiol.,* 1910, **24.**)

Widmark, *Erik M. P.* Untersuchungen über die chemischen Bedingungen für das Beibehalten der normalen Struktur der Zellen. I. and II. (From the *Skand. Archiv. Physiol.,* 1910, **23, 24.**)

THE LIBRARY.

The Library will be closed for Stocktaking from **Monday, August 14th**, until **Saturday, August 26th**, 1911, inclusive.

Fellows are particularly requested to return all Library Books in their possession not later than **Wednesday, August 9th.**

LIST OF FELLOWS, 1911.

The List of Fellows for 1911 is now in active preparation, and changes of address received after July 31st cannot be included in it.

In order that the new List may be as complete as possible, those Fellows whose degrees and Christian names do not appear in full are requested to communicate them to the Assistant Secretary.

R. CLAY AND SONS, LTD., BRUNSWICK ST. STAMFORD ST., S.E., AND BUNGAY, SUFFOLK.

[*Issued* 30/10/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 390.

The Council has ordered the following letter and report to be printed in the Journal and Proceedings of the Society:

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY,
ROYAL COLLEGE OF SCIENCE,
SOUTH KENSINGTON,
LONDON, S.W.
October 4th, 1911.

GENTLEMEN,

I beg to forward you the Annual Report of the International Committee on Atomic Weights for 1912, to which I have appended, as desired by them, the signatures of Professors Clarke, Ostwald, and Urbain.

Slight changes have been made in the atomic weights of calcium, erbium, iron, mercury, tantalum, and vanadium, which are indicated, in accordance with a suggestion received from Germany, by asterisks.

The only addition to the list of elements is that of niton (radium emanation), with the symbol Nt, and the atomic weight 222·4, as determined by Gray and Ramsay. This is in fair agreement with the value calculated by Debierne from observations on the rate of flow of the gas.

I have the honour to be, Gentlemen,
Your obedient servant,
T. E. THORPE.

To the Hon. Secretaries,
The Chemical Society,
Burlington House,
London, W.

Report of the International Committee on Atomic Weights, 1912.

Since the report of the Committee for 1911 was prepared, a number of important determinations of atomic weight have been published, which may be summarised as follows:

Nitrogen.—Guye and Drouginine (*J. Chim. Phys.*, 1910, **8**, 473), from seven analyses of N_2O_4, find, in mean, N=14·010.

Sulphur.—Burt and Usher (*Proc. Roy. Soc.*, 1911, *A*, **85**, 82), by analysis of nitrogen sulphide, N_4S_4, have determined the ratios S:N::1·0:0·43687. Hence, calculating with N=14·009, S=32·067, in good agreement with the accepted value.

Chlorine.—Burt and Gray (*Chem. News*, 1911, **103**, 161 and 170) have continued their work upon the density of hydrochloric acid, and confirmed their former determination of Cl=35·46.

Iodine.—Baxter (*J. Amer. Chem., Soc.*, 1910, **32**, 1591) has re-determined the ratio of iodine to silver with extreme care. Combining his results with the previously-determined ratio of silver to iodine pentoxide, he finds Ag=107·864 and I=126·913. The value for silver varies from that found by Richards and Willard, and the discrepancy is as yet unexplained.

Sodium.—Goldbaum (*J. Amer. Chem. Soc.*, 1911, **33**, 35) has made analyses of sodium chloride and bromide by a new electrolytic method. The salts were electrolysed with a mercury anode and a weighed silver cathode, and on the latter the halogen was collected in weighable form. From the chloride, with Cl=35·458, Goldbaum found Na=22·997; the bromide, with Br=79·920, gave Na=22·998.

Calcium.—Two papers by Richards and Hönigschmid (*J. Amer. Chem. Soc.*, 1910, **32**, 1577; 1911, **33**, 28) on the atomic weight of calcium have appeared. From analyses of calcium bromide, Ca=40·070, when Ag=107·88. From analyses of the chloride, Ca=40·074. The value 40·07 is adopted in the table at the end of this report.

Cadmium.—Perdue and Hulett (*J. Physical Chem.*, 1911, **15**, 155; see also Richards, *J. Amer. Chem. Soc.*, 1911, **33**, 888), from electrolytic analyses of cadmium sulphate, conclude that the atomic weight of cadmium is near 112·30. This is lower than the accepted value, but as the investigation is being continued with other salts of cadmium, any change in the table should be deferred.

Mercury.—Easley (*J. Amer. Chem. Soc.*, 1910, **32**, 1117) has continued his work on the atomic weight of mercury, varying his methods. New analyses of the chloride give Hg=200·63, in confirmation of his former determinations. In a private communication he states that analyses of the bromide lead to the same value. The new figure, Hg=200·6, should be adopted.

Vanadium.—McAdam (*J. Amer. Chem. Soc.*, 1910, **32**, 1603), by reducing sodium vanadate to sodium chloride, by heating in a stream of dry hydrochloric acid, finds V=50·967, or 51 in round numbers. The latter figure is as probable as any.

Tantalum.—Balke (*J. Amer. Chem. Soc.*, 1910, **32**, 1127), by hydrolysis of tantalum pentachloride, has determined the ratio $2TaCl_5 : Ta_2O_5$. The mean of five concordant determinations gives Ta=181·52, when Cl=35·46. The rounded-off value 181·5 should be accepted.

Tellurium.—Flint (*Amer. J. Sci.*, 1910, [iv], **30**, 209) has continued the work reported by Browning and Flint in 1909 on the fractionation of tellurium by hydrolysis of the tetrachloride. With successive fractions the atomic weight steadily decreased. Seven analyses of the basic nitrate representing the tenth fractionation gave values for Te ranging from 124·25 to 124·42. As the work is still in progress, any acceptance of these low figures would be premature.

Iron.—Baxter, Thorvaldson, and Cobb (*J. Amer. Chem. Soc.*, 1911, **33**, 319), from analyses of ferrous bromide, find Fe=55·838 when Ag=107·88. In another communication (*ibid.*, p. 337), Baxter and Thorvaldson find Fe=55·836. The latter figure is the mean of two series, *meteoric* iron being taken as the starting point. The value 55·84 is given in the table.

Uranium.—Oechsner de Coninck (*Compt. rend.*, 1911, **152**, 711 and 1179), by reduction of UO_2Cl_2 and UO_3,H_2O to UO_2 in hydrogen, concludes that U=238·5. The work is only approximate in character.

Scandium.—Meyer and Winter (*Zeitsch. anorg. Chem.*, 1910, **67**, 398), in a preliminary series of experiments, find values for Sc ranging from 44·86 to 45·37; in mean, 45·12. This is higher than the recognised value, but its adoption would be premature. More details are needed.

Neodymium.—By extended and careful analyses of the chloride, Baxter and Chapin (*Proc. Amer. Acad.*, **46**, 215) have redetermined the atomic weight of neodymium. From the ratio $NdCl_3:3Ag$, $Nd=144·268$. From the ratio $NdCl_3:3AgCl$, $Nd=144·272$. A small correction raises the value to 144·275. The rounded-off value 144·3, given in the table, may be properly retained.

Erbium.—Hofmann (*Ber.*, 1910, **43**, 2635), from analyses and syntheses of the sulphate of "neoerbium," finds $Er=167·68$. This may be rounded to 167·7.

Argon.—Determinations of the density of argon, by Fischer and Froboese (*Ber.*, 1911, **44**, 92), give a mean value of 19·95. Hence $A=39·90$.

Niton.—Gray and Ramsay (*Proc. Roy. Soc.*, 1910, *A*, **84**, 536), with the aid of the microbalance, have determined the density of the gaseous emanation from radium, to which they give the name *niton.* The mean value found gives $Nt=223$, but the value 222·4 is preferred (compare also Debierne, *Compt. rend.*, 1910, **150**, 1740). The gas is a member of the argon group, and seems to be entitled to recognition in the table.

The table of atomic weights for 1912 follows. In accordance with a suggestion received from Germany, the changed values are indicated by an asterisk. The changes are few in number, and only in two cases are they large.

F. W. Clarke.
W. Ostwald.
T. E. Thorpe.
G. Urbain.

1912.

International Atomic Weights.

		O=16.			O=16.
Aluminium	Al	27·1	Molybdenum	Mo	96·0
Antimony	Sb	120·2	Neodymium	Nd	144·3
Argon	A	39·88	Neon	Ne	20·2
Arsenic	As	74·96	Nickel	Ni	58·68
Barium	Ba	137·37	Niton* (radium emanation)	Nt	222·4
Bismuth	Bi	208·0	Nitrogen	N	14·01
Boron	B	11·0	Osmium	Os	190·9
Bromine	Br	79·92	Oxygen	O	16·00
Cadmium	Cd	112·40	Palladium	Pd	106·7
Cæsium	Cs	132·81	Phosphorus	P	31·04
Calcium*	Ca	40·07	Platinum	Pt	195·2
Carbon	C	12·00	Potassium	K	39·10
Cerium	Ce	140·25	Praseodymium	Pr	140·6
Chlorine	Cl	35·46	Radium	Ra	226·4
Chromium	Cr	52·0	Rhodium	Rh	102·9
Cobalt	Co	58·97	Rubidium	Rb	85·45
Columbium	Cb	93·5	Ruthenium	Ru	101·7
Copper	Cu	63·57	Samarium	Sa	150·4
Dysprosium	Dy	162·5	Scandium	Sc	44·1
Erbium*	Er	167·7	Selenium	Se	79·2
Europium	Eu	152·0	Silicon	Si	28·3
Fluorine	F	19·0	Silver	Ag	107·88
Gadolinium	Gd	157·3	Sodium	Na	23·00
Gallium	Ga	69·9	Strontium	Sr	87·63
Germanium	Ge	72·5	Sulphur	S	32·07
Glucinum	Gl	9·1	Tantalum*	Ta	181·5
Gold	Au	197·2	Tellurium	Te	127·5
Helium	He	3·99	Terbium	Tb	159·2
Hydrogen	H	1·008	Thallium	Tl	204·0
Indium	In	114·8	Thorium	Th	232·4
Iodine	I	126·92	Thulium	Tm	168·5
Iridium	Ir	193·1	Tin	Sn	119·0
Iron*	Fe	55·84	Titanium	Ti	48·1
Krypton	Kr	82·92	Tungsten	W	184·0
Lanthanum	La	139·0	Uranium	U	238·5
Lead	Pb	207·10	Vanadium*	V	51·0
Lithium	Li	6·94	Xenon	Xe	130·2
Lutecium	Lu	174·0	Ytterbium (Neoytterbium)	Yb	172·0
Magnesium	Mg	24·32	Yttrium	Yt	89·0
Manganese	Mn	54·93	Zinc	Zn	65·37
Mercury*	Hg	200·6	Zirconium	Zr	90·6

The following are abstracts of papers received during the vacation, and published, or passed for publication, in the *Transactions:*

192. "Indicators of the methyl-red type."

By Hubert Howard and Frank Geo. Pope. (Trans., 1911, 1333.)

Azo-compounds of the methyl-red type were prepared by combining diazotised anthranilic acid with *α*-naphthylamine, dimethyl-*α*-naphthylamine, diphenylamine, and phenyl-*α*-naphthylamine. Contrary to the statement of Tizard (*Trans.*, 1910, **97**, 2485), the potassium salt of methyl-red can be obtained in a crystalline form, and is not deliquescent.

193. "Dihydrocinnamenylcarbimide (*β*-Phenylethyl *iso*cyanate)."

By Martin Onslow Forster and Hermann Stötter. (Trans., 1911, 1337.)

Dihydrocinnamenylcarbimide, $C_6H_5{\cdot}CH_2{\cdot}CH_2{\cdot}N{:}C{:}O$, and some of its derivatives were studied, and in the course of their examination it was noticed that whilst this *iso*cyanate converts menthol into the corresponding carbamate, cinnamenylcarbimide transforms that alcohol into menthyl carbamate, a change which involves the disappearance of phenylacetylene.

194. "The synthesis of histidine."

By Frank Lee Pyman. (Trans., 1911, 1386.)

A preliminary account of the synthesis of *r*-histidine has already appeared (this vol., p. 92). The synthesis of histidine itself, that is, the naturally-occurring lævo-modification of this base, has now been completed by the resolution of *r*-histidine.

Both the *d*- and *l*-varieties have been obtained in a practically pure state by crystallisation of the hydrogen tartrates.

195. "The action of benzylamine on *s*-dibromosuccinic acid."

By Edward Percy Frankland. (Trans., 1911, 1775.)

When benzylamine reacts with *s*-dibromosuccinic acid in alcoholic solution it gives rise successively to the following compounds: (I) the *dibenzylamine* salt of dibromosuccinic acid, (II) the *monobenzylamine* salt of bromomaleic acid, (III) the *monobenzylamine* salt of *benzylaminobromosuccinic acid*,

$$CO_2H{\cdot}CH(NH{\cdot}C_7H_7){\cdot}CHBr{\cdot}CO_2H,$$

and (IV) the *monobenzylamine* salt of *dibenzylaminosuccinic acid*, $CO_2H{\cdot}CH(NH{\cdot}C_7H_7){\cdot}CH(NH{\cdot}C_7H_7){\cdot}CO_2H$, from which the free acid can be obtained by dissolving in hydrochloric acid and precipitating with water.

When the reaction is carried out in aqueous solution the products isolated are the *dibenzylamine* salt of dibenzylaminosuccinic acid and the *dibenzylamide* of *i*-tartaric acid. This formation of an amide in aqueous solution is to be accounted for by an intramolecular rearrangement demonstrated by Lutz (*Diss.*, Rostock) in the action of ammonia and other amines on monohalogen succinic acids, whereby amides of malic acid are produced.

196. "A method of determining carbon and nitrogen in organic compounds." By Edward Percy Frankland. (Trans., 1911, 1783.)

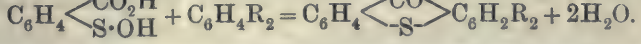
The Frankland-Armstrong vacuum combustion process (*Journ. Chem. Soc.*, 1868, **21**, 77) can be adapted for the estimation of carbon and nitrogen in organic compounds. The gases (carbon dioxide and nitrogen) evolved during the combustion of a known weight of substance, generally 0·1 gram or less, are collected, and measured over mercury in a graduated vessel; the carbon dioxide is then absorbed with aqueous potassium hydroxide, and the residual nitrogen transferred to a narrower graduated tube and measured over water.

The process can be carried out in less time than is required by the ordinary carbon-hydrogen combustion method, and the figures obtained both for nitrogen and carbon in a variety of organic compounds are in good agreement with theory. The presence of bromine in the molecule, even up to 80 per cent., has not been found to affect the accuracy of the results, hence this method appears to be of especial advantage in connexion with organic substances containing both nitrogen and halogen.

197. "The synthesis of derivatives of thioxanthone from aromatic disulphides." By Effie Gwendoline Marsden and Samuel Smiles. (Trans., 1911, 1353.)

The synthesis of thioxanthones may be accomplished by heating di-*o*-thiobenzoic acid or its derivatives with a suitable aromatic compound in presence of concentrated sulphuric acid, the interaction which takes place being summed up as follows:

$$(CO_2H\cdot C_6H_4\cdot S)_2 + H_2SO_4 = 2CO_2H\cdot C_6H_4\cdot S\cdot OH + SO_2.$$



$$C_6H_4{<}\begin{matrix}CO_2H\\ S\cdot OH\end{matrix} + C_6H_4R_2 = C_6H_4{<}\begin{matrix}CO\\ \text{-}S\text{-}\end{matrix}{>}C_6H_2R_2 + 2H_2O.$$

The method may be modified by arranging that the carboxyl group is present in the simple aromatic compound instead of in the disulphide; thus on heating *p*-dithiodimethylaniline with *m*-hydroxybenzoic acid and sulphuric acid, the corresponding thioxanthone is formed.

198. "Trialkylammonium nitrites and nitrites of the bases of the pyridine and quinoline series. Part II." By Pañchānan Neogi. (Trans., 1911, 1598.)

Picolinium nitrite is obtained, together with the nitrate, by concentrating an ice-cold solution in a vacuum desiccator. *Quinolinium nitrite* exists in solution, but not in the solid condition. *Piperidinium nitrite* has been obtained in colourless plates. *Pyridine methonitrite* is a reddish-yellow liquid. *Piperidine methonitrite* crystallises in colourless plates. *Picoline methonitrite* forms red crystals, and *quinoline methonitrite* dark red crystals.

199. "The density of liquid sucrose and of its solutions in water." By Frederik Schwers. (Trans., 1911, 1478.)

By melting sucrose under paraffin the author has succeeded in determining the density of liquid sucrose at temperatures between −15° and 115°.

The densities of aqueous solutions of sucrose containing 10, 20, 30, 40, 50, 60, and 70 per cent. of sucrose have also been determined.

200. "The condensation of crotonaldehyde." By Ida Smedley. (Trans., 1911, 1627.)

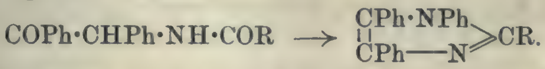
The condensation of crotonaldehyde under the influence of alkaline condensing agents has been studied. By oxidising the condensation product with silver oxide, and subsequently reducing with phosphorus and hydriodic acid, *n*-octoic acid has been identified. The γ-carbon atom of one crotonaldehyde molecule must therefore have reacted with the aldehyde group of a second molecule.

201. "Ionisation in non-aqueous solvents. Part I." By Harry Medforth Dawson and May Sybil Leslie. (Trans., 1911, 1601.

Measurements of the electric conductivity of non-aqueous solutions of alkali metal iodides and the corresponding polyiodides have shown that, in general, the polyiodides are ionised to a greater extent than the simple iodides. In methyl and ethyl acetate solutions the observed conductivity differences are very large, and in the latter solvent the polyiodides of potassium conduct from twenty-five to fifty times as well as the simple iodide. Evidence has been obtained in favour of the formation of definite polyiodides in such solutions, and the conductivity differences must be ascribed to differences in the degree of ionisation of the dissolved electrolyte. The simple alkali iodides would appear to be abnormally weak electrolytes when dissolved in methyl and ethyl acetates.

202. "The formation of glyoxalines from acyl derivatives of α-keto-β-anilino-αβ-diphenylethane." By Arthur Ernest Everest and Hamilton McCombie. (Trans., 1911, 1746.)

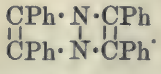
Glyoxalines can be prepared from acyl derivatives of α-keto-β-anilino-αβ-diphenylethane by heating these compounds in sealed tubes with aqueous ammonia:



$$\mathrm{COPh{\cdot}CHPh{\cdot}NH{\cdot}COR} \longrightarrow \begin{array}{l}\mathrm{CPh{\cdot}NPh}\\ \;\| \\ \mathrm{CPh{-\!\!-}N}\end{array}\!\!>\mathrm{CR.}$$

From the benzoyl, acetyl, and formyl derivatives respectively there have been prepared by this method 1 : 2 : 4 : 5-*tetraphenylglyoxaline*, 1 : 4 : 5-*triphenyl-2-methylglyoxaline*, and 1 : 4 : 5-*triphenylglyoxaline*. The *hydrochlorides*, *picrates*, and *platinichlorides* of these substances have also been prepared.

In the formation of all these glyoxalines there was obtained, in varying quantities, 2 : 3 : 5 : 6-tetraphenylpyrazine:



$$\begin{array}{lcl}\mathrm{CPh{\cdot}} & \mathrm{N} & \mathrm{{\cdot}CPh}\\ \| & | & \| \\ \mathrm{CPh{\cdot}} & \mathrm{N} & \mathrm{{\cdot}CPh}\end{array}$$

Some curious colour changes of α-keto-β-anilino-αβ-diphenylethane and its acyl derivatives have been noticed in the course of this work. α-Keto-β-anilino-αβ-diphenylethane itself is yellow, and gives a yellow solution in alcohol, but this solution becomes colourless on the addition of a drop of acid. The acyl derivatives, on the other hand, are colourless, and yield colourless solutions, but these solutions become strongly yellow on the addition of a drop of alkali. The probability is that there exist ketonic and enolic modifications of these substances.

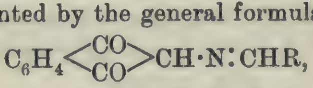
203. "The osmotic pressure and conductivity of aqueous solutions of Congo-red, and on reversible membrane-equilibria." By Frederick George Donnan and Albert Buckley Harris. (Trans., 1911, 1554.)

Measurements of osmotic pressure and electrical conductivity show that, although aqueous solutions of Congo-red are very considerably ionised, they exhibit an osmotic pressure corresponding very closely with the value calculated for single undissociated molecules. On dialysis, solutions of Congo-red suffer a gradual "membrane-hydrolysis." Constant values of osmotic pressure can only be obtained in presence of small concentrations of alkali hydroxide. The effect of various concentrations of sodium hydroxide and sodium chloride on the osmotic pressure has been studied. It has been shown experimentally and theoretically that a non-dialysing electrolyte such as Congo-red causes an unequal distribution of sodium chloride on either side of the membrane (in this case, parchment paper).

204. "**Triketohydrindene hydrate. Part V. The analogues of uramil and purpuric acid.**" By **Siegfried Ruhemann.**

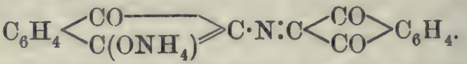
(Trans., 1911, 1486.)

Diketohydrindamine, $C_6H_4<\begin{smallmatrix}CO\\CO\end{smallmatrix}>CH\cdot NH_2$, which is formed by the reduction of oximinodiketohydrindene, $C_6H_4<\begin{smallmatrix}CO\\CO\end{smallmatrix}>C\cdot NOH$, by means of stannous chloride (*Trans.*, 1911, **99**, 1306), could not be obtained pure, owing to the ease with which it is oxidised by the oxygen of the air. It was characterised, however, by the condensation products which it yields with aromatic aldehydes. These substances, which may be represented by the general formula



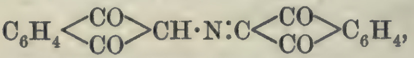
$$C_6H_4<\begin{smallmatrix}CO\\CO\end{smallmatrix}>CH\cdot N:CHR,$$

are not very stable, and are readily hydrolysed to the compounds from which they are formed. The blue coloration which is produced on exposure of diketohydrindamine to moist air is due to the formation of the analogue of murexide, which is the *ammonium* salt of *diketohydrindylidenediketohydrindamine*,



$$C_6H_4<\begin{smallmatrix}CO\text{———}\\C(ONH_4)\end{smallmatrix}>C\cdot N:C<\begin{smallmatrix}CO\\CO\end{smallmatrix}>C_6H_4.$$

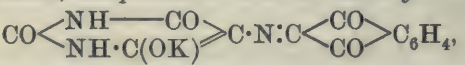
This can be prepared from hydrindantin under conditions similar to those which served for the production of murexide from alloxantin (Piloty and Finckh, *Annalen*, 1904, **333**, 27). The ketone,



$$C_6H_4<\begin{smallmatrix}CO\\CO\end{smallmatrix}>CH\cdot N:C<\begin{smallmatrix}CO\\CO\end{smallmatrix}>C_6H_4,$$

corresponding with this salt was also isolated; it is, however, readily decomposed by mineral acids.

By the action of triketohydrindene hydrate on uramil dissolved in potassium hydroxide, the *potassium* salt of *diketohydrindylideneuramil*,



$$CO<\begin{smallmatrix}NH\text{——}CO\\NH\cdot C(OK)\end{smallmatrix}>C\cdot N:C<\begin{smallmatrix}CO\\CO\end{smallmatrix}>C_6H_4,$$

is produced; it dissolves in water to yield reddish-violet solutions, which are decolorised by dilute hydrochloric acid.

It was found that the colour-reaction which the triketone gives with amino-acids is based on the formation of the ammonium salt of diketohydrindylidenediketohydrindamine.

205. "The constitution of the organic ferrocyanides." By Ernald George Justinian Hartley. (Trans., 1911, 1549.)

In order to throw some light on the constitution of the ferrocyanides, the decomposition of tetramethyl ferrocyanide, $(CH_3)_4FeC_6N_6$, and hexamethyl ferrocyanogen dihydrogen sulphate, $(CH_3)_6FeC_6N_6H_2(SO_4)_2$ (*Trans.*, 1910, **97**, 1066, 1725), has been studied. The former, on heating with concentrated sulphuric acid, gave a mixture of ammonium and methylammonium sulphates, whilst the latter, under similar conditions, gave only methylammonium sulphate. Decomposition of the hexamethyl compound with sodium hydroxide also led only to the formation of methylamine derivatives. From this the conclusion is drawn that all the methyl groups are attached directly to nitrogen atoms in both the substances examined.

206. "Contributions to the chemistry of the terpenes. Part IX. The oxidation of camphene with hydrogen peroxide." By George Gerald Henderson and Maggie Millen Jeffs Sutherland. (Trans., 1911, 1539.)

Camphene, when dissolved in glacial acetic acid, is oxidised by a 30 per cent. aqueous solution of hydrogen peroxide, yielding a mixture of products, which includes both acids and neutral compounds. The acid present in largest quantity, *camphylic acid*, $C_9H_{15}{\cdot}CO_2H$, is a crystalline solid, m. p. 95°, and when heated with acetic anhydride is transformed into the isomeric *iso*camphenilanic acid. From the *chloride* of camphylic acid, $C_9H_{15}{\cdot}COCl$, by bromination and subsequent treatment of the product with water, *bromocamphylic acid*, $C_9H_{14}Br{\cdot}CO_2H$, was obtained in crystals, melting at 210°. When heated with aqueous sodium carbonate the bromo-acid is converted into the crystalline *hydroxycamphylic acid*, $C_9H_{14}(OH){\cdot}CO_2H$, m. p. 245°. The latter does not give a ketone when oxidised with lead peroxide.

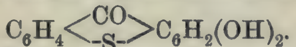
Camphenilone, $C_9H_{14}O$, a ketone which has been prepared from camphene in other ways, is the chief component of the mixture of neutral oxidation products. iso*Camphenilanaldehyde*, $C_9H_{15}{\cdot}CHO$, which is also present, is very similar in properties to the isomeric camphenilanaldehyde, but yields *iso*camphenilanic acid on exposure to the air. Its semicarbazone melts at 191—192°, and the semicarbazone prepared from camphenilanaldehyde appears in reality to be this compound. Among the other neutral products, together with a very little camphene glycol, $C_{10}H_{16}(OH)_2$, and a trace of a crystalline substance which melts at about 69°, there occurs a *compound* which apparently has the formula $C_9H_{16}O_2$. When heated to a high temperature with phthalic anhydride this compound yields a crystalline *ester*, from which, by hydrolysis, an *alcohol* of the formula $C_9H_{16}O$ is obtained.

207. "Synthesis of derivatives of thioxanthone. Part III. 1 : 4-Dihydroxythioxanthone." By Hans Thacher Clarke and Samuel Smiles. (Trans., 1911, 1535.)

When *p*-benzoquinone is allowed to react with *o*-thiolbenzoic acid, 2′-*carboxy*-2 : 5-*dihydroxydiphenyl sulphide* is produced:

$$C_6H_4O_2 + HS{\cdot}C_6H_4{\cdot}CO_2H = C_6H_3(OH)_2{\cdot}S{\cdot}C_6H_4{\cdot}CO_2H.$$

The latter on treatment with cold sulphuric acid loses water, and is converted into 1 : 4-*dihydroxythioxanthone*,



$$C_6H_4{<}\genfrac{}{}{0pt}{}{CO}{S}{>}C_6H_2(OH)_2.$$

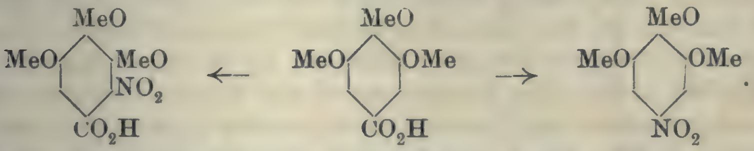
This substance and its salts are strongly coloured, but do not appear to be of practical value as dyestuffs.

208. "Optically active derivatives of 1-methyl*cyclo*hexylidene-4-acetic acid." By William Henry Perkin, jun., and William Jackson Pope. (Trans., 1911, 1510.)

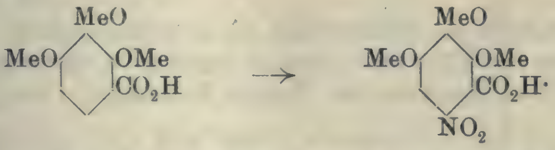
The optical activity of *d*- and *l*-1-methyl*cyclo*hexylidene-4-acetic acid is due to the configuration of the molecule exhibiting a particular type of enantiomorphism unassociated with asymmetry of any particular atom present; the authors give the name "centroasymmetric" to this type of enantiomorphism. They now describe the conversion of optically active centroasymmetric compounds into substances containing an asymmetric carbon atom, and also the reverse change; they show that the optical activity of the original substance is preserved during the change in either direction. The change from the one to the other type of enantiomorphous configuration is thus unaccompanied by optical inversion.

209. "Substitution in aromatic hydroxy-compounds. Part I. The action of nitric acid on gallic acid trimethyl ether and pyrogallolcarboxylic acid trimethyl ether." By **Victor John Harding**. (Trans., 1911, 1585.)

Gallic acid trimethyl ether on treatment with nitric acid under varying conditions undergoes the following reaction:



Pyrogallolcarboxylic acid trimethyl ether under similar conditions yields only the nitro-acid:



No substitution of the carboxyl group was observed. As the substitution of carboxyl groups by the nitro-group is partly dependent on its position in the molecule, the hypothesis is put forward that carboxyl-substitution is governed by those forces in the molecule which direct substitution in the parent phenol ether, and that there is no real difference between hydrogen-substitution and carboxyl-substitution.

210. "The solubility of cuprous oxide in aqueous ammonia solutions, and the composition of the cuprous-ammonia complex." By **Frederick George Donnan** and **John Smeath Thomas**. (Trans., 1911, 1788.)

The solubility of crystalline cuprous oxide in solutions of ammonia of different concentrations has been determined at 25°. It is found that for a certain range of ammonia concentrations the concentration of total copper is approximately proportional to the square root of the "free" ammonia. From this result the conclusion is drawn that in these solutions the cuprous-ammonia hydroxide present is mainly of the type $(Cu \cdot NH_3)OH$.

211. "The acid character of gallotannic acid."

By **Ramni Paniker** and **Edmund Stiasny**. (Trans., 1911, 1819.)

The authors have applied Bredig and Fraenkel's method to the determination of the hydrion concentration of gallotannic acid.

This method is based on the dissociation of diazoacetic ester by the catalytical action of hydrions, the concentration of which determines the speed of the development of nitrogen. Different samples of gallotannic acid, prepared by different—and partly new—methods of purification, were used, and their acid character was found distinctly greater than could be explained by the presence of phenolic groups only, thus leading to the conclusion that free carboxylic groups are present. This confirms the views of Schiff and Nierenstein, but does not agree with those of Böttinger (*Ber.*, 1884, **17**, 1503), Walden (*Ber.*, 1898, **31**, 3170), and Dekker (*Ber.*, 1906, **39**, 2497). The authors are of the opinion that even the purest gallotannic acid obtainable is no single substance, but a mixture of at least two components of allied character.

212. "Synthesis of polypeptides of α-amino-*n*-nonoic acid with glycine, alanine, valine, leucine, asparagine, and aspartic acid." By Arthur Hopwood and Charles Weizmann. (Trans., 1911, 1577.)

As polypeptides of α-amino-*n*-nonoic acid with glycine and other amino-acids probably occur in the degradation products of the proteins contained in beetroot, the leaves of *Pelargonium roseum*, and other plants, the authors have prepared the following derivatives of α-amino-*n*-nonoic acid:

α-Bromo-n-*nonoyl chloride*, $C_8H_{16}Br{\cdot}COCl$, prepared by heating α-bromo-*n*-nonoic acid with phosphorus pentachloride, is a colourless liquid boiling at 108—110°/9 mm. When condensed with glycine in the presence of sodium hydroxide it gives *α-bromo*-n-*nonoylglycine*, $C_8H_{16}Br{\cdot}CO{\cdot}NH{\cdot}CH_2{\cdot}CO_2H$, which forms a mixture of colourless, rhombic plates and rhombic prisms, melting at 115·5—117°. The crystals are only sparingly soluble in cold water or benzene, but readily so in alcohol, ether, or alkalis.

α-Amino-n-*nonoylglycine*, $NH_2{\cdot}C_8H_{16}{\cdot}CO{\cdot}NH{\cdot}CH_2{\cdot}CO_2H$, is prepared by heating α-bromo-*n*-nonoylglycine with concentrated aqueous ammonia. It forms a mixture of colourless, monoclinic needles and rhombic plates, which sinters at 205°, and melts and decomposes at 215—216°. It is fairly soluble in water, almost insoluble in alcohol or benzene, but readily soluble in alkalis or mineral acids. Like the proteins, it yields a white, amorphous precipitate with phosphotungstic acid. but unlike the corresponding dipeptide, α-aminolaurylglycine, it is not hydrolysed by enzymes or bacteria.

Somewhat similar bromo-compounds are prepared by the condensation of α-bromo-*n*-nonoyl chloride with alanine, valine, leucine, asparagine, and aspartic acid, and these on heating with ammonia yield the corresponding dipeptides. Similarly, the tripeptide *leucyl-*

*a-amino-*n*-nonoylglycine* is prepared by condensing *a*-amino-*n*-nonoylglycine with *a*-bromo*iso*hexoyl bromide, and then displacing the bromine by an amino-group through the action of ammonia.

213. "Latent heats of vaporisation of mixed liquids. Part I."

By Dan Tyrer. (Trans., 1911, 1633.)

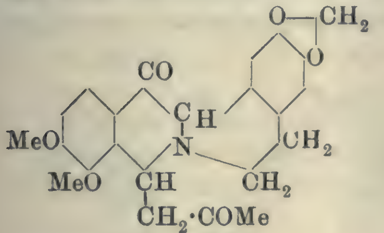
In order to determine the latent heats of mixed liquids the liquid is contained in a bottle provided with a thermometer ground into its neck. In the liquid is immersed a coil of platinum wire of known resistance, through which is passed a known current. The liquid, which has first been heated to its boiling point by an external bath, immediately boils, and the amount of liquid evaporated by the known amount of electricity is determined by weighing before and after. This gives all the necessary data. As, however, with mixed liquids the boiling point rises as the evaporation proceeds, a correction must be made for heat used in raising the temperature of the liquid. This is determined in a second experiment by determining the heat capacity of the liquid with the containing vessel.

Measurements have been made for three cases of normal mixtures. The latent heat cannot be regarded as a linear function of the composition of the mixture, but depends also on the composition of the vapour.

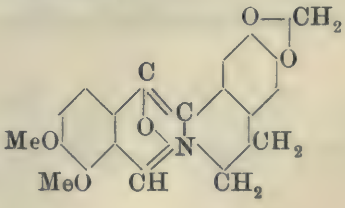
214. "*iso*Quinoline derivatives. Part VI. *neo*Oxyberberine."

By Frank Lee Pyman. (Trans., 1911, 1690.)

Berberineacetone, $C_{23}H_{23}O_5N$, yields on oxidation with permanganate in aqueous acetone neo*oxyberberineacetone*, $C_{23}H_{23}O_6N$ (I). When this substance is hydrolysed by dilute acids, salts of neo*oxyberberine*, $C_{20}H_{17}O_5N$ (II), are obtained:



(I.)



(II.)

The phenolbetaine constitution assigned to *neo*oxyberberine is supported by its general properties, and particularly by its behaviour with methyl iodide, when *methoxyberberinium iodide* is produced. *neo*Oxyberberine is readily reduced to tetrahydroberberine, and its chloroform solution suffers spontaneous oxidation in the air, with formation of 1-keto-6:7-methylenedioxytetrahydro*iso*quinoline and 1-ethyl hydrogen hemipinate.

215. "The system: palmitic acid-sodium palmitate." By Frederick George Donnan and Albert Simpson White. (Trans., 1911, 1668.)

The compositions of the solid and liquid phases in equilibrium with each other have been determined over the temperature-range 60—82°. The solid phases consist of three series of solid solutions. No pure acid salts appear to separate as stable phases in the region of temperature and concentration investigated.

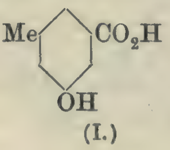
216. "The β-chlorocinnamic acids."
By Thomas Campbell James. (Trans., 1911, 1620.)

The various methods for the preparation of the two β-chlorocinnamic acids have been examined, and the proportion of the isomerides obtained in each case determined. A quantitative separation is possible by means of the barium salts in aqueous solution; the *allo*-acid is readily, and the other sparingly, soluble.

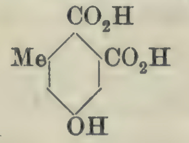
The transformation of the acid melting at 132·5° into that melting at 142° under the influence of heat and of sunlight, and the rate of elimination of hydrogen chloride by means of alkali, establishes the acid melting at 132·5° as the *allo*-isomeride.

217. "Substances related to cochenillic and carminic acids. Part I. Synthesis of the methyl ether of β- and of γ-coccinic acids." By Andrew Norman Meldrum. (Trans., 1911, 1712.)

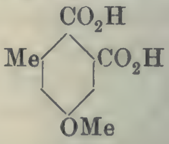
Starting with 5-hydroxy-*m*-toluic acid (I), the author has synthesised two methoxyphthalic acids which are related to cochenillic acid (IV). One of them is the methyl ether (III β) of β-coccinic acid (II β), whilst the other is the methyl ether (III γ) of an unknown substance (II γ), which may be called γ-coccinic acid.



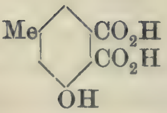
(I.)



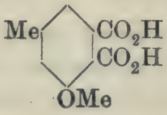
(II β.)



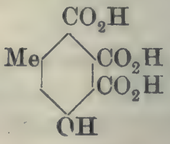
(III β.)



(II γ.)



(III γ.)



(IV.)

218. "The synthesis of hydrocarbons at high temperatures." By John Norman Pring and Dorian Macefield Fairlie. (Trans., 1911, 1796.)

A method has been applied for the detection of the synthesis of traces of hydrocarbons produced when pure carbon, in the form of a rod, is heated electrically in an atmosphere of hydrogen. At 1200°, and at pressures from 10 to 60 cm., carbon combines with hydrogen to give methane and ethylene, the rate of formation of the latter being about 1/100 that of the methane. No acetylene could be detected by this method at this temperature (1200°).

Measurements made of the rate at which acetylene and ethylene react with hydrogen to give methane show that sufficient time was not allowed in the above experiments for any large interaction of ethylene or acetylene with hydrogen to occur, so that the formation of the hydrocarbons must have been direct.

At 1400°, and at pressures between 10 and 40 cm., methane and acetylene are obtained, the rate of formation of the latter being about 1/10 that of the former.

At 1650° methane, ethylene, and acetylene are obtained, and, as at higher temperatures, the quantity of ethylene is about twice that of the acetylene.

Palladium, in contact with the carbon, was found to assist catalytically the formation of methane to the same degree as platinum, whilst silicon had no appreciable effect.

The presence of a highly charged electric field surrounding the carbon made no appreciable difference to the rate of formation of methane at temperatures between 1200° and 1600°, so that no complication is produced in the reaction by ionisation from heated carbon.

The formation of ethylene, which has not before been observed at these low temperatures, can just be detected by the special method employed for the analysis, at 1200°, and at 1400° it is comparable with the methane formed.

219. "2:2′-Dibromodiphenyl and 2:2′-dichlorodiphenyl." By James Johnston Dobbie, John Jacob Fox, and Arthur Josiah Hoffmeister Gauge. (Trans., 1911, 1615.)

The authors have studied the action of cuprous bromide on the tetrazonium salt derived from 2:2′-diaminodiphenyl. They show that, according to the conditions, the products are, on the one hand, mainly diphenyleneazone, $(C_6H_4N)_2$, and carbazole, and, on the other, a small amount of 2:2′-*dibromodiphenyl*, large quantities of carbazole, and traces of diphenyleneazone.

2 : 2′-Dibromodiphenyl crystallises from alcohol in long, colourless prisms, melting at 81°. Diphenylene is formed by the action of sodium on the substance dissolved in dry ether (*Trans.*, 1911, **99**, 683). Fluorene results from the action of sodium on a mixture of 2 : 2′-dibromodiphenyl and methylene dibromide.

2 : 2′-*Dichlorodiphenyl*, formed similarly to the dibromo-compound, crystallises from light petroleum in nodular masses of crystals, melting at 59°.

220. "The absorption spectra of various chlorine and bromine derivatives of benzene and of toluene as vapours, in solution, and in thin films." By John Edward Purvis. (Trans., 1911, 1699.)

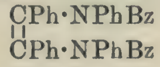
The general results are that: (1) each vapour possesses a considerable number of bands which can be divided into groups, regulated by the type and number of the side-chains; (2) alcoholic solutions of the substances give considerably fewer bands, and of a different type from the vapour bands; and (3) the bands observed through very thin films are not unlike the solution bands, and differ only in position.

221. "The effect of heat on a mixture of benzaldehydecyanohydrin and aniline." By Arthur Ernest Everest and Hamilton McCombie. (Trans., 1911, 1752.)

The following substances were found to be produced in this reaction:

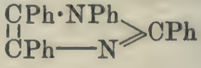
(1) After half an hour's heating a quantitative yield of anilinophenylacetonitrile, CN·CHPh·NHPh, is obtained. This substance has not been prepared previously without the use of either a sealed tube or a catalyst.

(2) If the heating is continued for forty-eight to ninety-six hours, *dibenzoyldianilinostilbene* (I) is formed:



$$\begin{array}{l}\text{CPh·NPhBz}\\ \|\\ \text{CPh·NPhBz}\end{array}$$

(I.)



$$\begin{array}{l}\text{CPh·NPh}\\ \|\\ \text{CPh——N}\end{array}\!\!\gg\text{CPh}$$

(II.)

(3) Mixed with compound (I) was generally 1 : 2 : 4 : 5-tetraphenylglyoxaline (II). These two compounds were separated by taking advantage of the insolubility of the former in hot ether.

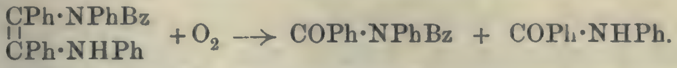
(4) α-Keto-β-anilino-$\alpha\beta$-diphenylethane was sometimes isolated in the reaction.

(5) Benzanilide was also found to be present.

Dibenzoyldianilinostilbene can be decomposed quantitatively by potassium hydroxide, yielding the monobenzoyl compound and benzoic acid.

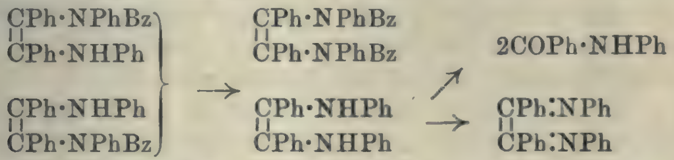
The constitution of these two compounds (the dibenzoyl and the monobenzoyl) was established by the decompositions undergone by *monobenzoyldianilinostilbene* (*a*) in solution, (*b*) on heating.

A solution of benzoyldianilinostilbene undergoes atmospheric oxidation, yielding benzanilide and dibenzoylaniline:



$$\begin{matrix}\mathrm{CPh\cdot NPhBz}\\ \|\\ \mathrm{CPh\cdot NHPh}\end{matrix} + O_2 \longrightarrow \mathrm{COPh\cdot NPhBz} + \mathrm{COPh\cdot NHPh}.$$

Benzoyldianilinostilbene when heated undergoes decomposition, regenerating the dibenzoyl compound, and forming benzanilide and benzildianil in addition:

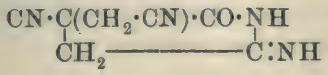


$$\left.\begin{matrix}\mathrm{CPh\cdot NPhBz}\\ \|\\ \mathrm{CPh\cdot NHPh}\\ \\ \mathrm{CPh\cdot NHPh}\\ \|\\ \mathrm{CPh\cdot NPhBz}\end{matrix}\right\} \longrightarrow \begin{matrix}\mathrm{CPh\cdot NPhBz}\\ \|\\ \mathrm{CPh\cdot NPhBz}\\ \\ \mathrm{CPh\cdot NHPh}\\ \|\\ \mathrm{CPh\cdot NHPh}\end{matrix} \begin{matrix}\nearrow\\ \\ \longrightarrow\end{matrix} \begin{matrix}\mathrm{2COPh\cdot NHPh}\\ \\ \mathrm{CPh{:}NPh}\\ \|\\ \mathrm{CPh{:}NPh}\end{matrix}$$

Benzoyldianilinostilbene is strongly yellow, but a colourless modification has been prepared. By spectroscopic means it has been established that the salts are derived from the colourless variety, and not from the yellow form.

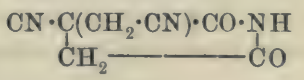
222. "The formation and reactions of imino-compounds. Part XVI. Reactions leading to the formation of tricarballylic acid." By Ferdinand Bernard Thole and Jocelyn Field Thorpe. (Trans., 1911, 1684.)

Cyano-amides having the nitrile group in the γ-position readily pass into imino-derivatives of the five-membered ring; thus the condensation of iodoacetonitrile and the sodium compound of cyanoacetamide gives the imino-compound (I), from which the imide (II) can be produced by the action of acids, and ultimately tricarballylic acid (III):



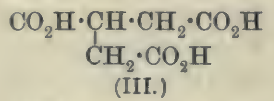
$$\begin{matrix}\mathrm{CN\cdot C(CH_2\cdot CN)\cdot CO\cdot NH}\\ \mathrm{CH_2\text{———————}C{:}NH}\end{matrix}$$

(I.)



$$\begin{matrix}\mathrm{CN\cdot C(CH_2\cdot CN)\cdot CO\cdot NH}\\ \mathrm{CH_2\text{———————}CO}\end{matrix}$$

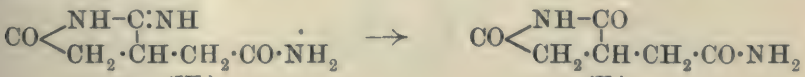
(II.)



$$\begin{matrix}\mathrm{CO_2H\cdot CH\cdot CH_2\cdot CO_2H}\\ \mathrm{CH_2\cdot CO_2H}\end{matrix}$$

(III.)

The imino-compound (IV) is produced when the sodium compound of ethyl cyanoacetate is condensed with iodoacetamide. It yields the imide (V) when treated with acids, and tricarballylic acid on further hydrolysis:



$$\mathrm{CO}{<}\begin{matrix}\mathrm{NH{-}C{:}NH}\\ \mathrm{CH_2\cdot CH\cdot CH_2\cdot CO\cdot NH_2}\end{matrix} \longrightarrow \mathrm{CO}{<}\begin{matrix}\mathrm{NH{-}CO}\\ \mathrm{CH_2\cdot CH\cdot CH_2\cdot CO\cdot NH_2}\end{matrix}$$

(IV.) (V.)

There is no tendency to form either the three- or the four-carbon ring through the agency of the imino-group.

223. "Composition of the essential oil of Myrica Gale, L."

By Samuel Shrowder Pickles. (Trans., 1911, 1764.)

The oil of *Myrica Gale*, L. (bog myrtle, sweet gale, etc.) required for this investigation was distilled from specimens of the plant collected in Argyllshire. Two separate consignments of the raw material contained different proportions of leaves and twigs, and the oils obtained in the two cases consequently varied somewhat in character. The oil obtained from a sample consisting mostly of leaves was pale yellow. It had a pleasant, herb-like odour, and possessed the following chemical and physical characters:

Yield of oil on air-dried material, 0·203 per cent.; D_{15}^{15} 0·912; $\alpha_D - 11°26'$; acid value $= 4·0$; total saponification value $= 23·2$; ester value $= 19·2$; saponification value of acetylated oil $= 56·4$.

The constituents of the oil were found to include the following substances: (1) a crystalline paraffin hydrocarbon, m. p. 63—64°, having probably the composition $C_{29}H_{60}$ (0·75 per cent.); (2) free palmitic acid (2·5 per cent.); (3) terpenes, including dipentene; (4) cineole; (5) esters of fatty acids; (6) a mixture of alcohols of high boiling points; and (7) a sesquiterpene.

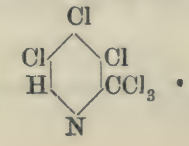
The cineole and terpenes together constitute approximately 50 per cent. of the oil.

224. "Trimercuridiethylammonium nitrite." By Prafulla Chandra Rây and Jitendra Nath Rakshit.

By the interaction of ethylamine and mercuric nitrite, both dimercuriammonium nitrite and trimercuridiethylammonium nitrite are obtained; a large excess of ethylamine favours the formation of the latter. This new compound is of interest as being the alkyl-substituted product of mercuriammonium nitrite.

225. "The chlorine derivatives of pyridine. Part XI. Some interactions of 3:4:5-trichloropicolinic acid and of its derivatives." By William James Sell. (Trans., 1911, 1679.)

One of the chief compounds obtained by the chlorination of α-picoline has the constitution represented by the formula:



This substance has been shown to produce by the action of sulphuric acid—besides 3:4:5-trichloropicolinic acid and 3:4:5-trichloropyridine already described—a small quantity of another substance, most probably 4:5-*dichloro-3-hydroxypicolinic acid*. This substance is resolved by heat into the corresponding *dichlorohydroxypyridine*. The above hexachloropicoline also reacts with alcoholic sodium hydroxide, and yields 3:5-*dichloro-4-hydroxypicolinic acid*, also resolved by heat into the corresponding *dichlorohydroxypyridine*, isomeric with the above dichlorohydroxypyridine.

It is also shown that 3: 4: 5-trichloropicolinic acid yields, when heated with ammonia at 140°, 3: 5-*dichloro-4-aminopicolinic acid*, which, when heated, gives 3: 5-*dichloro-4-aminopyridine*.

Further, the last-mentioned compound forms, when the amino-group is replaced by the hydroxyl group, the same dichlorohydroxypyridine as is obtained by the action of alcoholic sodium hydroxide on the original hexachloropicoline and heating the dichlorohydroxypicolinic acid thus produced.

226. "An application of Kirchhoff's equation to solutions. (A contribution to the thermodynamic theory of solubility.)" By Robert Taylor Hardman and James Riddick Partington. (Trans., 1911, 1769.)

It is shown that a general differential equation of van't Hoff may be integrated by an application of a theorem of Kirchhoff relating to the influence of temperature on heat of reaction. The resulting equation gives the solubility of a substance in terms of the absolute temperature and three constants:

$$\log S = A - B/T - C\log T,$$

and is shown to agree very closely with the results of experiment.

227. "The aerial oxidation (rusting) of metals." By Wyndham Rowland Dunstan and John Richard Hill. (Trans., 1911, 1835.)

In continuation of previous work, the authors have investigated the cause of the inhibiting effect of certain substances, for example, alkalis, potassium dichromate, etc., on the rusting of iron and other metals. It has been found that this effect is in all cases the result of the establishment of a "passive" condition of the metal, during the continuance of which the metal does not rust. The effect persists long after the metal has been removed from the inhibiting solution and carefully washed with water. Contact of passive iron with certain salts or dilute acids, including carbonic acid, more or less rapidly destroys the passivity, and rusting ensues. The authors point out that many of the results recently quoted in support of the carbonic acid theory of rusting are invalidated by the facts now recorded, and further evidence is produced in favour of the conclusion maintained in previous papers, that the presence of carbonic acid is not essential to the rusting process.

The authors record the results of experiments showing that the electrolytic theory of rusting cannot be maintained. It is also shown that other metals besides iron exhibit the phenomena of rusting, and are also capable of assuming the passive state.

228. "The passivity of iron and certain other metals." By Wyndham Rowland Dunstan and John Richard Hill. (Trans., 1911, 1853.)

The authors find that the passive state of iron is induced by solutions, in many cases by dilute solutions of a number of salts, such as potassium dichromate, chromate, iodate, chlorate, ferrocyanide, and also by alkalis and alkaline salts, and that, besides iron and metals of the iron group, other metals, including magnesium, lead, zinc, and copper, are also capable of assuming the passive state under the same conditions. Passivity is destroyed more or less rapidly by contact with solutions of certain salts, such as sodium chloride, and also dilute acids, including carbonic acid. It can also be removed by scratching or brushing the surface of the passive metal, as well as by other mechanical means.

The destruction of passivity by sodium chloride solution does not take place unless oxygen is present, and the effect is electrolytic, resulting in a slight electrolysis of the salt. In the absence of air, it is found that passivity is not destroyed by sodium chloride or by certain other salts.

The evidence obtained points strongly to the conclusion that passivity is the result of the formation of a film on the surface of the metal. The results of experiments show that this film probably does not consist of "physically" altered metal or of a gas film. The passivity of iron is destroyed by heating in a vacuum to 400°, and disappears when passive iron is heated in hydrogen to 240—250°, at which temperature it is known that magnetic oxide of iron is reducible by hydrogen. The observed facts point to the conclusion that "passivity" is probably the result of the formation of a solid film of oxide on the surface of the metal. It has not, however, been hitherto recognised that certain metals, and especially iron, are capable of oxidation through cold dilute alkaline solutions.

229. "The reactivity of ketones towards iodine and the relative rates of tautomeric change. Part II." By Harry Medforth Dawson and Harry Ark. (Trans., 1911, 1740.)

Further measurements have been made of the rate of tautomeric change of dialkyl ketones and substituted acetophenones. The experiments were made in 40 per cent. alcoholic solution with 0·1 molar sulphuric acid as catalyst, and iodine as speed indicator.

The rate of change of the symmetrical dialkyl ketones diminishes with increase in the number of carbon atoms in the alkyl group. The data for methyl propyl and methyl *iso*propyl, methyl butyl and methyl *iso*butyl ketones, show that substitution of the normal by the *iso*alkyl group reduces the reactivity of the ketone by about 25 per cent. The reactivity of methyl *tert.*-butyl ketone, in which the butyl group represents an inactive radicle, is only about two-fifths as great as that of the corresponding normal ketone. Substitution of a hydrogen atom of the phenyl group in acetophenone by a negative atom or group leads to a reduction in the rate of tautomeric change, and similar substitution of one of the hydrogen atoms of the methyl group appears to prevent the change from taking place.

230. "The photochemical and thermal interaction of chlorine and carbon monoxide." By David Leonard Chapman and Frank Houghton Gee. (Trans., 1911, 1726.)

The authors have continued the investigation of the inhibition observed in photochemical changes when certain impurities are present in very small amounts. The substances which hinder the photochemical interaction of carbon monoxide and chlorine are those which act as inhibitors towards the action of chlorine on hydrogen under the influence of light. The effect of oxygen on the former change has been investigated quantitatively. The thermal union of chlorine and carbon monoxide is homogeneous in character under the conditions prevailing in the experiments performed, that is, when the action proceeds in glass vessels and the area of glass is not extremely large in comparison with the size of the vessel in which the change takes place. The most important conclusion drawn from the results is that the afore-mentioned inhibition is limited to the photochemical change: the inhibitors in question have no influence on the thermal change. This fact was established by measurements being made of the rate of union of chlorine and carbon monoxide in the light and in the dark, at a temperature of 315°, both in the presence and in the absence of nitrosyl chloride. When nitrosyl chloride was present, the rate of union was the same in the dark as in the light; but when it was absent, the rate of union in the light was the greater, the rate of union in the dark being the same as that observed when nitrosyl chloride had been admitted to the mixture.

231. "Decomposition of dry ozone." By David Leonard Chapman and Herbert Edwin Jones. (Trans., 1911, 1811.)

Ozone desiccated by long exposure to phosphoric oxide, and ozone dried by contact with concentrated sulphuric acid, decompose at the same rate under the same conditions. From this result, and from the results obtained in a previous research by the same authors (*Trans.*, 1910, **97**, 2463), the inference is drawn that ozone can revert to oxygen without the intervention of any other substance.

232. "The absorption spectra of the isomeric hydrazones and semicarbazones of camphorquinone." By Frederick Russell Lankshear and Arthur Lapworth. (Trans., 1911, 1785.)

The spectra fall into two sets, suggesting a classification of the compounds into two series which are identical with the α- and β-series into which they were grouped by Forster and Zimmerli (*Trans.*, 1910, **97**, 2156; 1911, **99**, 478). The points of difference between the two classes are not sufficiently marked appreciably to weaken the case in favour of the view that the relationship is stereochemical.

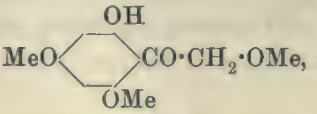
233. "Bimolecular glycollaldehyde." By Nial Patrick McCleland. (Trans., 1911, 1827.)

The author has investigated the behaviour of bimolecular glycollaldehyde in different solvents and in the state of vapour to ascertain whether it is a kind of acetal formed from two molecules, the hydroxyl group of the one reacting with the aldehyde group of the other and vice versa, or whether the phenomenon is due to molecular association of an unusually intense kind. The conclusion is drawn that the latter is the case, and with the aid of the absorption spectrum of the bimolecular solution it is found possible to make a suggestion as to the character of association in general.

234. "Myricetin. Part III."

By Arthur George Perkin. (Trans., 1911, 1721.)

Myricetin hexamethyl ether, $C_{15}H_4O_2(OMe)_6$, which occurs in colourless, prismatic needles, melting at 154—156°, is readily prepared by the action of methyl sulphate on the potassium salt of myricetin pentamethyl ether (compare Waliaschko, *Arch. Pharm.*, 1904, **242**, 242), or by methylating myricetin with alkali and methyl sulphate. When hydrolysed with alcoholic potassium hydroxide, it gives gallic acid trimethyl ether and 2-hydroxyfisetol trimethyl ether:



$$\mathrm{MeO}\overset{\mathrm{OH}}{\underset{\mathrm{OMe}}{\langle\quad\rangle}}\mathrm{CO{\cdot}CH_2{\cdot}OMe},$$

identical with that obtained by Herzig from quercetin pentamethyl ether (*Ber.*, 1909, **42**, 158). Myricetin hexaethyl ether (*Trans.*, 1902, **81**, 206) behaves similarly, with production of gallic acid triethyl ether and 2-*hydroxyfisetol triethyl ether*, which forms prismatic needles, melting at 96—97°. These results confirm the hydroxy-quercetin constitution previously assigned to myricetin.

235. "The influence of inactive electrolytes on the optical activity of *l*-malic acid in aqueous solution." By Clifford Morgan Stubbs.

The addition to an optically active solution of various salts and acids which themselves are inactive and do not chemically combine with the active solute, provides a method of varying the solvent in a simple and more or less understood manner. Malic acid was selected as being a well-studied active substance, particularly sensitive to changes in the solvent. For comparative purposes a solution of malic acid of constant strength (20 per cent.) was used, to which the various anhydrous salts and acids were added in certain equivalent proportions, and their effect on the specific rotation, mainly for sodium light, determined. The influences observed were, in general, considerable, those for barium and calcium salts being extraordinarily large, and showed the existence of simple relations between the influence of the salt and its chemical nature. The main conclusions are:

(1) The influence of salts is not due to their affinity for water.

(2) The influence is mainly a property of the radicles or ions; for salts of strong bases it is an additive ionic property.

(3) The property is not due to chemical reaction or adjustment

of ionic equilibrium. Ions within the sphere of influence of an active molecule appear to possess the specific power of affecting its degree of asymmetry to an extent depending mainly on their concentration, and not on that of the malic acid. No connexion has been found between this power and any known physical properties of the solvent due to the dissolved electrolyte.

(4) The divergencies of the alkaline malates (according to Schneider's data) from obeying Oudeman's law appear explicable on the ground of the continued influence of the dissociated, but necessarily adjacent, metal ion.

(5) Thomsen's supposed complex-formation between sodium malate and excess of alkali seems explicable on the ground of ionic influence.

236. "New derivatives of diphenoquinone and a new variety of stereoisomerism" By James Moir.

By oxidising 4 : 4′-dihydroxy-3 : 3′-ditolyl in various ways, *ditoluquinone* has been obtained apparently in two stereoisomeric forms, namely, a 3 : 3′- or *cis*-form (red) and a 3 : 5′- or *trans*-form (yellow). Both modifications give an orange-brown coloration with sulphuric acid, and are quantitatively reduced by stannous chloride to 4 : 4′-dihydroxy-3 : 3′-ditolyl. On mild oxidation, dihydroxyditolyl gives *ditoluquinhydrone*, which forms black needles with a green reflex, and gives a blue coloration with sulphuric acid; the sodium derivative is a bluish-purple jelly. *Ditoluquinonedi-imine* results by oxidising tolidine by Willstätter's method, and is similar to his "diphenoquinonedi-imine," but the properties of both are anomalous, and they are probably polymerides of the true di-imines.

The nitrate of the true *ditoluquinhydronedi-imine* is easily obtained from tolidine nitrate and ferric nitrate in aqueous solution; it forms opaque, blue needles with a bronze lustre, and is hydrolysed by water, the blue solution depositing the *basic nitrate* as a bright blue jelly with a coppery lustre, which can be prepared directly by the action of the theoretical amount of chromium trioxide on tolidine nitrate. When excess of potassium dichromate is used instead, the *dichromate* of *ditoluquinhydronedi-imine*

$$(C_{14}H_{14}N_2 + C_{14}H_{16}N_2 + H_2Cr_2O_7)$$

is obtained; this is the tetramethyl derivative of the so-called "benzidine chromate," which has recently been shown to be diphenoquinhydronedi-imine dichromate.

Dibromoditoluquinone has been isolated in two modifications by oxidising 5 : 5′-dibromo-4 : 4′-dihydroxy-3 : 3′-ditolyl; it forms scarlet needles with a faint green lustre, and paler lozenges. It gives a scarlet coloration with sulphuric acid, becoming magenta on dilution. Like the parent substance, it is practically unaffected by sodium hydroxide. The corresponding *quinhydrone*

$$(C_{14}H_{10}O_2Br_2 + C_{14}H_{12}O_2Br_2)$$

is obtained by reducing the quinone with bisulphite, or directly from dibromodihydroxyditolyl by oxidation with ferric chloride in dilute alcohol, or with bromine in acetic acid. It forms needles like graphite, giving a blue coloration in sulphuric acid; the sodium derivative is bright blue, and easily decomposed.

The following new substances are described: 5:5′-*dibromo*-4:4′-*dibenzoyloxy*-3:3′-*ditolyl*, m. p. 239°; the 4:4′-*diacetoxy*-compound, m. p. 198°; 5-*bromo*-6-*hydroxy*-m-*toluic acid*, m. p. 233°; 3-*bromo*-3′-*nitro*-4:4′-*dihydroxy*-3:3′-*ditolyl*; 5:5′-*dinitro*-4:4′-*dihydroxy*-3:3′-*ditolyl*; and *barium* 4:4′-*dihydroxy*-3:3′-*ditolyldisulphonate*.

Thursday, October 19th, 1911, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society, through death, of the following Honorary and Foreign Members:

	Elected.	*Died.*
Prof. Albert Ladenburg	Feb. 2nd, 1888	Aug. 15th.
Prof. Walthere Spring	Jan. 20th, 1898	July 17th.
Prof. Louis Joseph Troost	„ „ „	Sept. 30th.

It was announced that the Berthelot Memorial Lecture would be delivered by Professor Harold B. Dixon, F.R.S., on Thursday, November 23rd, 1911, at 8.30 p.m.

Messrs. Irvine Masson, Edwin B. Hughes, H. Horace Ward, and L. O. Newton were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Arthur Cecil Bescoby, B.A., Guestling, Hastings.

Bertram Alfred Bull, Government Road, Nairobi, British E. Africa.

Joseph Beauchamp Bull, Bulawayo, S. Africa.

Edwin Johnson Charlton, M.Sc., Morannedd, Beaumaris, North Wales.

Barun Chandra Dutt, M.A., Rambogan Cottage, Rambogan, Calcutta.
Arthur Josiah Hoffmeister Gauge, 2, Ashford Avenue, Hornsey, N.
Sydney Hall, B.Sc., Birley House, Station Road, March.
Cyril Vincent Hodgson, 80, Apedale Road, Chesterton.
Henry James Hodsman, M.Sc., 2, Richmond Hill, Langley, Birmingham.
Alexander Frederick Hogg, M.A., 81, Claremont Road, Forest Gate, E.
Robert Mills, Plantation Uitolugt W.C., Demerara, British Guiana.
B. Wiswa Nath, 46, Nagappa Modali Street, Komaleswarapet, Madras, India.
Thomas Peers Parkes, B.Sc., 22, Dalrymple Road, Brockley, S.E.
David Henry Peacock, B.A., B.Sc., 40, Huddart Street, Bow, E.
B. Venkata Rao, B.A., Bangalore, Mysore, India.
Joseph Reilly, B.A., 25, South Circular Road, Portobello, Dublin.
Noël Douglas Ridsdale, Ravenscroft, Roman Road, Middlesbrough.
William Bristow Saville, 117, Vassall Road, Brixton, S.W.
Bernard Charlie Smith, 62, Filey Avenue, Upper Clapton, N.E.
John Henry Smith, 10, Radnor Street, Swindon.
Kapibram H. Vakil, B.A., B.Sc.Tech., No. 5, Santa Cruz, Bombay, India.
Harry James Vipond, B.A., Dept. of Agriculture, Pretoria, S. Africa.
Ernest Walter Wright, Connaught Club, Seymour Street, W.

Of the following papers, those marked * were read:

*237. "The alkaline condensations of nitrohydrazo-compounds." By Arthur George Green and Ernest Arthur Bearder.

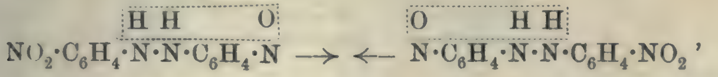
The authors have studied the action of aqueous alkali hydroxides on 4:4′-dinitrohydrazobenzene, and have ascertained that condensations occur analogous to those which give rise to the stilbene dyestuffs. A close parallelism is thus indicated between the nitroazo- and the nitrostilbene series.

The blue colour produced when 4:4′-dinitrohydrazobenzene is dissolved in cold alkali hydroxides is apparently due to the formation of the quinonoid salt:

$$(M'O)NO{:}C_6H_4{:}N{\cdot}N{:}C_6H_4{:}NO(OM'),$$

since the original compound is reprecipitated unchanged when the freshly prepared solution is acidified. When, however, the solution is kept at the ordinary temperature for several hours, a slow change of colour from pure blue to violet-blue occurs, with simultaneous precipitation of dinitroazobenzene. The solution after removal of the latter then gives on acidification *4-nitroso-4′-nitrohydrazobenzene*, $NO\cdot C_6H_4\cdot NH\cdot NH\cdot C_6H_4\cdot NO_2$, which crystallises from acetone in small, orange-red cubes having a violet reflex, and decomposes without melting sharply at about 203°. Its alkali salts are violet-blue.

It is rather unstable, and when boiled with neutral solvents or with aqueous alkali hydroxides undergoes further condensation according to the scheme:



$$NO_2\cdot C_6H_4\cdot \overset{H}{N}\cdot \overset{H}{N}\cdot C_6H_4\cdot \overset{O}{N} \longrightarrow \longleftarrow \overset{O}{N}\cdot C_6H_4\cdot \overset{H}{N}\cdot \overset{H}{N}\cdot C_6H_4\cdot NO_2\ ,$$

giving *bisnitrobenzeneazo-azobenzene.* The latter can also be obtained without prior isolation of the intermediate nitroso-derivative by heating the alkaline solution of dinitrohydrazobenzene for some time at 100° until the disappearance of the blue colour. It forms small, orange-red needles, is very sparingly soluble in solvents, and melts at 285—286°.

*238. “The characteristics and chemical composition of some early matches.” By Edwy Godwin Clayton.

A description was given, and specimens were shown, of the Promethean match (date 1828), one of the numerous forms of “chemical matches” (ignited by the contact of sulphuric acid with a chlorate mixture) which preceded the non-phosphoric “friction-lights,” invented in 1826–1827 by John Walker, and ignitable when drawn through folded sand paper. Some of the non-phosphoric “lucifer matches,” which were soon afterwards manufactured in many quarters on the same principle as Walker's matches, but were usually sulphur-coated (Walker's were not, although the opposite is sometimes stated to be the case), were also described, and specimens were exhibited. The author has fixed the identity of the first user of the designation “Lucifers.” It was Samuel Jones, who, having previously introduced the Prometheans, next manufactured friction matches closely resembling Walker's, and called them “Jones's Lucifers,” or “chlorate matches.” Analyses of Prometheans, and of two varieties of lucifer matches, British and foreign, are summarised in table I. Many inaccurate statements have been made about the Promethean matches, especially in reference to the composition of the igniting mixture, and the character of the glass vessel containing the acid. The last-named differs widely from that which most of the published descriptions would lead the reader to expect.

TABLE I.

	Class : Chemical Matches.		*Class : Lucifer Matches.*	
	Promethean Matches. Maker, S. Jones. Date, 1828. Igniting composition.	*The same.* Liquid in minute glass tube.*	No. 1. *English "Lucifer Matches."* Maker, R. Bell & Co. Date, 1832–33.	No. 2. *French Matches (Lucifers).* Maker's name unknown. Date, 1832–33.
Sulphur	24·7	—	6·5	12·5
Antimony sulphide ...	—	—	24·6	18·1
Lycopodium	8·8	—	—	—
Potassium chlorate ...	34·9	—	27·6	41·0
Ferric oxide	—	—	5·6	3·5
Gum......................	31·6	—	35·7	24·9
Sulphuric acid (H_2SO_4)	—	61·9	—	—
Water	—	38·1	—	—
Indigo.....................	—	(minute quantity)	—	—
	100·0	100·0	100·0	100·0

* Tube about 7 mm. long and 1 mm. wide.

Early in the 'thirties were introduced "Congreve" matches, which differed from lucifers in that they contained phosphorus, and were ignitable by being "struck upon the box." Congreves, which were probably so named after the inventor of the war rocket, Sir W. Congreve, Bt., then recently deceased, were largely manufactured on the Continent, especially in Germany and Austria. They varied greatly in quality and appearance, although not much in composition. In table II are given the results of analyses of six kinds of Congreves. Some curious "Cigarren Zünder" (phosphoric, and ignitable by friction), made about 1850 by a Viennese manufacturer, and Austrian matches of later date (included in table II), were also described.

TABLE II.

	Class: Congreve Matches.							*Class: Matches of later date.*	*Class: Cigar Lighters.*
	No. 1. *German* (?) *Matches.* Labelled: "Best London Congreves." No maker's name. (Period, between 1838 and 1840.)	No. 2.* *German Matches.* On the label: "These matches invented and improved by Congreve . . ." Also an illustration of a hand *striking a match.* Matches packed in bran . . . Maker's initials "J.C.K." (Supposed date c. 1835.)	No. 3. *German Matches.* "Chemische Streichfeuerzeuge." Maker, H. Link, of Darmstadt (Period, probably earlier than 1840.)	No. 4. *German Matches.* Labelled: "Superior Congreves from one of the greatest and most famous German manufactories." Maker's initials "I.N.E." (Period, 1840—50.)	No. 5. *German Matches.* Labelled: "Superior Congreve matches from one of the greatest and most famous German manufactories." Maker's initials "I.N.E." (Period, 1840–50.)	No. 6. Rubbing composition on the boxes of No. 5.	No. 7. *Austrian Matches.* Initials, "B.F. in S." (Bernard Fürth of Schüttenhofen ?) (Period, 1845—50.)	No. 8. *Austrian Matches.* Maker and date unknown. (Period probably later than any of the preceding.)	No. 9. *Austrian Cigar Lighters.* "D'Bleaml'n Cigarren Zünder." Maker, A. N. Pollak, Vienna. (Date, c. 1850.)
Ordinary phosphorus	10·5	20·5	13·0	6·9	7·7	—	17·8	5·5	7·1
Sulphur	12·7	14·3	9·0	20·4	6·7	—	11·5	3·2	10·2
Potassium chlorate	43·3	32·1	60·7	39·0	38·8	—	37·4	54·8	20·0
Potassium nitrate	—	—	—	—	—	—	—	—	11·4
Glass (pulverised)	—	—	—	—	14 9	—	—	—	2·6
Sand	—	—	—	—	—	32·8	—	—	—
Chalk or whitening	12·5	8·0	—	—	6·3	—	—	—	—
Ferric oxide	—	—	—	—	—	41·2	—	—	11·8
Gum	21·0	—	—	—	—	—	33·3	36·5	—
Dextrin, etc.	—	25·1	17·3	—	—	—	—	—	—
Starch	—	(Wheat starch present)	(Much starch)	—	—	—	—	—	—
Glue	—	—	—	33·7	25·6	26·0	—	—	33·9
Dye	(Traces)	(Minute quantity of a blue dye)	(Blue dye)	—	(Prussian blue)	—	?	?	—
	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0

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* These were probably among the phosphoric friction matches earliest sold in this country.

*239. "Experiments on the Walden inversion. Part VII. Action of phosphorus pentachloride and of thionyl chloride on optically active hydroxy-acids and esters." By Alex. McKenzie and Fred Barrow.

The authors have examined the action of thionyl chloride on *l*-mandelic acid, methyl *l*-mandelate, ethyl *l*-mandelate, *l*-malic acid, ethyl *l*-malate, ethyl *d*-tartrate, *l*-α-hydroxy-β-phenylpropionic acid and its ethyl ester, and *d*- and *l*-β-hydroxy-β-phenylpropionic acids. The action of phosphorus pentachloride has been examined in the case of *d*- and *l*-α-hydroxy-β-phenylpropionic acids and their ethyl esters, and also in the case of *d*-β-hydroxy-β-phenylpropionic acid. The behaviour of the latter acid and its *l*-isomeride towards hydrochloric acid has also been studied.

Discussion.

The President asked Dr. McKenzie whether he had observed any differences in the amount of racemisation occurring according as phosphorus pentachloride or thionyl chloride respectively were employed, and also according as the free acid or an ester respectively were acted on by these reagents.

In reply to the President, Dr. McKenzie stated that a Walden inversion is accompanied in the great majority of cases by racemisation, which is often very pronounced. When the action of phosphorus pentachloride and of thionyl chloride towards any one hydroxy-acid (or its ester) is contrasted, it is found that the former has invariably a greater racemising influence than the latter; thus, the crude dextrorotatory phenylchloroacetic acid obtained by the action of phosphorus pentachloride on *l*-mandelic acid is optically active to a much less degree than the crude lævorotatory phenylchloroacetic acid obtained by the action of thionyl chloride on *l*-mandelic acid. A similar effect was noted in the behaviour of *l*-atrolactinic acid towards phosphorus pentachloride and thionyl chloride respectively (McKenzie and Clough), and there are numerous other instances of the same kind.

In reply to Dr. Forster, it was stated that the method recently described by Darzens (*Compt. rend.*, 1911, **152**, 1601) of replacing the hydroxy-group by chlorine by the action of thionyl chloride on esters of hydroxy-acids in the presence of a tertiary base was not attempted by the authors. By the action of thionyl chloride on ethyl *l*-malate studied by the authors, a satisfactory yield of ethyl *d*-chlorosuccinate with $[\alpha]_{D}^{19\cdot8} + 32\cdot7^{\circ}$ was readily obtained, whereas Darzens, carrying out the action in the presence of pyridine, found $[\alpha]_{D}^{20} + 31\cdot2^{\circ}$.

*240. "Note on the preparation of the *syn.*-aldoximes."

By Albert Ernest Dunstan and Ferdinand Bernard Thole.

The method for the preparation of benz-*syn*-aldoxime discovered by Beckmann (*Ber.*, 1889, **22**, 429, 1531) consists in saturating an ethereal solution of the *anti*-oxime with dry hydrogen chloride and subsequently decomposing the precipitated hydrochloride with aqueous sodium carbonate.

The authors have found that a much more simple and expeditious preparation can be performed by suspending the finely powdered *anti*-oxime in cold concentrated hydrochloric acid, and leading in hydrogen chloride to saturation, when, in the case of benzaldoxime, the hydrochloride passes into solution, and, in the case of piperonaldoxime, the salt is precipitated.

On pouring the resulting solution or suspension into excess of aqueous sodium carbonate, a voluminous precipitate of the *syn*-modification appears, which can be collected, dried on porous earthenware, and crystallised from benzene. Almost theoretical yields have been obtained in the cases of benzaldoxime, piperonaldoxime, anisaldoxime, and *m*-nitrobenzaldoxime.

*241. "The absorption spectra of the nitration products of dimethyl-*p*-toluidine."

By Gilbert T. Morgan and Arthur Clayton.

2-Nitrodimethyl-*p*-toluidine and 3-nitrodimethyl-*p*-toluidine exhibit absorption spectra quite comparable with those of the nitroanilines and nitrotoluidines, the absorption curves showing the broad, well-defined band which is characteristic of this series of bases.

2 : 5-Dinitrodimethyl-*p*-toluidine, which contains its nitro-groups unsymmetrically arranged on either side of the dimethylamino-radicle, gives an absorption curve still showing the characteristic band, but somewhat narrowed and modified. 2 : 6-Dinitrodimethyl-*p*-toluidine and 3 : 5-dinitrodimethyl-*p*-toluidine, in each of which the two nitro-groups are in symmetrical positions with respect to the basic group, give absorption curves differing from the typical form, owing to the almost complete suppression of the absorption band.

The substitution of a third nitro-group in the 2 : 6-isomeride decreases the symmetry of the molecule, and the product, 2 : 3 : 6-trinitrodimethyl-*p*-toluidine, again shows a well-defined absorption band.

The least symmetrical base examined was 2 : 3-dinitromethyl-*p*-toluidine, which contains all its substituents in consecutive positions. This substance gave the typical form of absorption curve with the most persistent band of the series.

The observed difference between the absorption spectra of 2:6- and 3:5-dinitrodimethyl-*p*-toluidines and those of the other bases of this group is due, however, only in part to the symmetrical grouping of the nitro-groups; it is dependent, also, on the presence of the unsaturated basic radicle, for when the basicity is largely destroyed by the replacement of an *N*-methyl by a nitroso-group, similar spectra are exhibited, as, for example, with 3:5-dinitro-*p*-tolylmethylnitrosoamine, 2:5-dinitro-*p*-tolylmethylnitrosoamine, and the corresponding *N*-nitroamine.

242. "The action of Allium sativum or garlic-juice on lead and mercury." By Manindranath Banerjee.

When the juice of macerated garlic-cruciferæ is triturated with highly impure mercury (containing lead) in a mortar for several hours, a pasty mass adheres to the sides of the mortar, and the mercury remains behind. On adding water to the pasty mass, after removing the mercury, a greyish-black precipitate is formed, which, after being collected, dried in the air, and rendered free from minute particles of mercury, proves to be a mixture of lead sulphide (PbS) and a little mercuric sulphide (HgS). The mercury which has been removed, being partly free from lead and other impurities, is repeatedly subjected to the same treatment with garlic-juice, and after three or four hours' rubbing, it is seen to be quite free from lead, and shows all the qualities of pure mercury, when the garlic would no longer act on it.

The sulphur present in the garlic acts on the lead to form lead sulphide (PbS). The higher sulphides present in the oil of garlic, such as diallyl disulphide, propyl allyl disulphide, etc., are reduced to the lower ones, for example, diallyl disulphide is changed into diallyl sulphide or allyl sulphide; this oily liquid mixes with the lead sulphide to form a pasty mass. On adding water, the allyl sulphide and gummy matter present in garlic are dissolved, and lead sulphide is precipitated. The allyl sulphide is partly converted into allyl alcohol, hydrogen sulphide being evolved, which at once attacks the mercurous oxide always present in impure mercury, forming black mercurous sulphide ($HgS + Hg$) and water. The lead and mercuric sulphides are separated from the mercury, which is thus obtained completely free from lead and mercurous oxide, and is found to be perfectly purified. It has been observed that garlic has no action on pure mercury, and its action on lead alone, even in the finest state of division, is extremely slow, whilst it readily attacks an amalgam of mercury and lead. In the case of diallyl disulphide the reaction may be represented thus:

$$(C_3H_5)_2S_2 + Pb = (C_3H_5)_2S + PbS,$$
$$(C_3H_5)_2S + 2H_2O = 2C_3H_5{\cdot}OH + H_2S,$$
$$H_2S + Hg_2O = Hg_2S \text{ or } (HgS + Hg) + H_2O;$$

or, $(C_3H_5)_2S_2 + Pb + Hg_2O = 2C_3H_5{\cdot}OH + (PbS + HgS) + H_2O + Hg.$

243. "Note on *p*-methoxysalicylaldehyde and its occurrence in the root of a species of Chlorocodon." By Ernest Goulding and Russell George Pelly.

In a previous note (*Proc.*, 1908, **24**, 62) it was shown that the odorous constituent of the roots of *Chlorocodon* sp., is the methyl ether of a dihydroxybenzaldehyde, $OMe{\cdot}C_6H_3(OH){\cdot}CHO$, m. p. 41—42°, but that owing to the lack of sufficient material its configuration had not been established.

A further quantity of the root was subsequently received at the Imperial Institute from Uganda, and was distilled with steam, the yield of the aldehyde amounting in this case to little more than 0·25 per cent., as compared with 0·5 per cent. from the earlier sample.

When the compound was fused with potassium hydroxide it furnished either β-resorcylic acid or resorcinol, depending on the temperature at which the experiment was carried out, thus proving that the substance is *p*-methoxysalicylaldehyde,

$$OMe{\cdot}C_6H_3(OH){\cdot}CHO[4:2:1].$$

This conclusion has already been reached by Friedländer (*Monatsh.*, 1910, **30**, 879), who obtained the compound by the action of sodium hydroxide on 4-methoxybenzene-2-indoleindigo (formed by the condensation of isatin chloride with resorcinol methyl ether). Friedländer's substance melted at 41°, and was identified with the compound from *Chlorocodon* roots by means of the oxime and phenylhydrazone described in the earlier paper (*loc. cit.*).

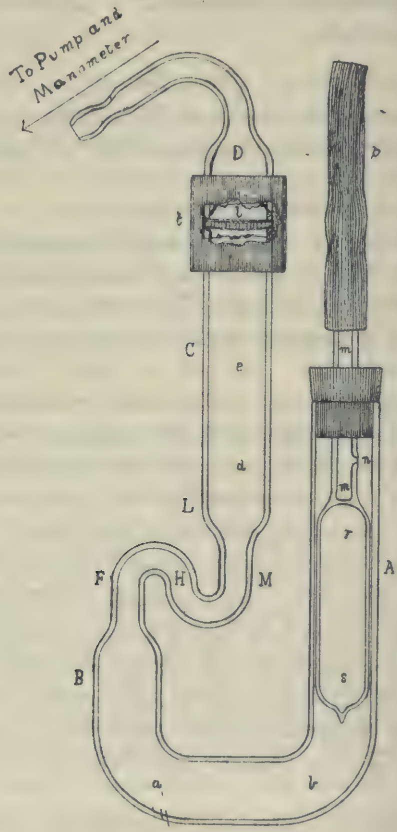
When an alcoholic solution of the aldehyde (1 mol.) is warmed with aniline (1 mol.), condensation readily takes place, with formation of p-*methoxysalicylideneaniline*, $OMe{\cdot}C_6H_3(OH){\cdot}CH{:}NPh$, which separates in long, narrow, lustrous, yellow plates, and, after recrystallisation from alcohol, melts at 67—68°:

0·4410 gave 23·5 c.c. N_2 (moist) at 12·5° and 750 mm. N = 6·22.

$C_{14}H_{13}O_2N$ requires N = 6·17 per cent.

244. "A simple apparatus for sublimation in a vacuum." By Harold Christopher.

In the course of some recent researches on thioxanthones it was desired to purify these substances by sublimation in a vacuum. It was found, however, that, owing to the great density of the vapours, diffusion to the cold part of the sublimation tube was an exceedingly slow process. To overcome this difficulty the idea was conceived of drawing a current of air over the substance, and for this purpose the apparatus illustrated by the accompanying figure was designed. Essentially it consists of a glass tube *ABCD*, of which the region *ab* contains the substance to be sublimed, and is heated in an oil- or metal-bath, whilst the limb *C*, into which the vapours of the substance are carried by a current of air, serves as the cooling chamber. In order to prevent the sublimate which collects in the region *de* from falling back on the unsublimed substance, the tube



is constricted and bent, as shown at *FHM*, and to avoid condensation and consequent blocking at this part, the apparatus is immersed in the bath up to the level *L*. The current of air, which is regulated by means of a screw-clip compressing the indiarubber tube *p*, enters the apparatus through the glass tube *mm*, from which it issues by the orifice *n*, and passes down the cylindrical space between the outer wall of the sealed and exhausted tube *rs* and the inner wall of the limb *A* of the sublimation tube. From here it passes over the substance to the condensing limb *C*, and thence through a filter, shown in section at *l*, to the pump. This filter, which is of great importance, the outlet tubes invariably becoming choked if it is omitted, consists of a piece of filter-paper held against the undersurface of a perforated porcelain disk. It rests on the end of the condensing limb, and is held in place by the head *D* and the thick rubber band *t*. Should the tube *rs* be omitted, vortices are formed, and some of the vapour of the substance is carried to the cool part of the limb *A*, where it condenses. It is not essential that this tube should be sealed at the junction with *m*, but it is perhaps preferable, as any contamination of the inside would be very troublesome to remove. If it is sealed it is safer to exhaust it, at least as completely as is possible, with a water-jet pump, since, when in use, it is surrounded by an atmosphere at low pressure and high temperature. Some idea of the amount of air passing may be obtained by inserting a mercury bubbler between the apparatus and the pump. The substance to be sublimed is, of course, introduced through the limb *A*, and the sublimate scraped out of the limb *C*, the head and filter being removed for the purpose.

This device has proved of great utility in the researches alluded to above. The external diameter of the tube employed was five-eighths of an inch, and the total height about 7 inches. The working pressure was usually about 40 mm. (internal), at which a quite sufficiently rapid stream of air was drawn through by the water-jet pump used, whilst the temperature was in the neighbourhood of 200°.

245. "Note on the dehydration of crystals."
By James Brierley Firth.

The removal of water of crystallisation from various salts by means of calcium carbide has been described by Irvine Masson (*Trans.*, 1910, **97**, 851), who finds that in most cases complete dehydration can be obtained, the rapidity of dehydration depending on the vapour pressure of the hydrate.

In the case of copper, zinc, and magnesium sulphates, the final stage is that of the monohydrate.

The author has conducted a series of similar experiments, using phosphoric oxide, and it was found that the above sulphates could be rendered completely anhydrous. The extent of the dehydration was determined by taking the monohydrate, and in all three cases it was further dehydrated by phosphoric oxide.*

It would appear, therefore, that the apparent stability of the monohydrate, when calcium carbide is used, must be due to the conditions under which the dehydration is carried out.

The decomposition of calcium carbide results in the production of calcium hydroxide. Now it would appear that, if during dehydration any hydrate was formed which had a vapour pressure equal to, or lower than, that of calcium hydroxide, further dehydration would not be possible.

From the following table it will be seen that this is the case with copper, zinc, and magnesium sulphates.

Vapour pressures at 25°.*

$CuSO_4,5—3H_2O$	7·0 mm.		$MgSO_4,6—7H_2O$	11·5 mm.	
$CuSO_4,1—3H_2O$	4·7 ,,		$MgSO_4,5—6H_2O$	9·8 ,,	
$CuSO_4,0—1H_2O$	0·8 ,,	(0·5) †	$MgSO_4,4—5H_2O$	8·8 ,,	
$ZnSO_4,6—7H_2O$	13·6 ,,		$MgSO_4,1—4H_2O$	4·9 ,,	
$ZnSO_4,1—6H_2O$	12·8 ,,		$MgSO_4,0—1H_2O$	1·0 ,,	(0·5) †
$ZnSO_4,0—1H_2O$	1·0 ,,	(0·5) †	CaO,H_2O	0·8 ,,	

* Foote and Scholes, *J. Amer. Chem. Soc.*, 1911, **33**, 1324.

† Müller-Erzbach, *Ber.*, 1881, **14**, 1093, and *Zeitsch. physikal. Chem.*, 1888, **2**, 113.

The vapour pressures of all three monohydrates are very low, and not known very accurately, but they are probably near to that of calcium hydroxide. In all other cases where the dehydration is complete, using calcium carbide, the vapour pressure of the lowest hydrate is higher than that of calcium hydroxide.

The use of phosphoric oxide involves the production of phosphoric acid, and hence secondary reactions frequently occur. In the case of barium chloride the acid reacts with the anhydrous salt, giving a regular stream of hydrogen chloride. This seems to furnish a simple method of preparing fairly pure dry hydrogen chloride. It may be easily done by mixing powdered crystals of barium chloride with phosphoric oxide in a test-tube. In a few minutes hydrogen chloride is evolved, the rate depending on the intimacy of the mixture.

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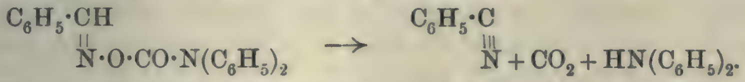
* It is well known that copper sulphate can be completely dehydrated at 50° by concentrated sulphuric acid.

246. “The diphenylcarbamyloximes.” (Preliminary note.)

By Frederick Percy Dunn.

The diphenylcarbamyloximes of benzaldehyde and the three nitrobenzaldehydes have been prepared by heating equivalent quantities of diphenylcarbamyl chloride and the sodium salts of the “*anti*”-oximes in dry chloroform or ether. It was found that the same compound was obtained by condensing diphenylcarbamyl chloride with the sodium salt of benz*anti*aldoxime as with that of benz*syn*aldoxime, either by heating or more slowly at the ordinary temperature. Treatment with alcoholic potassium hydroxide gave diphenylamine and benzonitrile, this result showing that the diphenylcarbamyloxime is a “*syn*” derivative (compare Hantzsch, *Ber.*, 1891, **24**, 17):



$$\begin{matrix} C_6H_5\cdot CH \\ \Vert \\ N\cdot O\cdot CO\cdot N(C_6H_5)_2 \end{matrix} \longrightarrow \begin{matrix} C_6H_5\cdot C \\ \vert\vert\vert \\ N \end{matrix} + CO_2 + HN(C_6H_5)_2.$$

The syn-*diphenylcarbamyloxime* of benzaldehyde crystallises in colourless, flat needles, decomposing at 163° (Maquenne block). The three diphenylcarbamyloximes of the nitrobenzaldehydes decompose about the same temperature, and all become yellow on exposure to light. As it was found that the sodium salt prepared from *o*-nitrobenz*syn*aldoxime was mainly an “*anti*”-salt, the further investigation of the diphenylcarbamyloximes has been postponed in order to study the metallic salts of the oximes. The author also hopes to prepare the carbamyloximes and the phenylcarbamyloximes.

247. “Some reactions of phenyl *iso*propyl ketone.”

By Arthur Lapworth and Victor Steele.

As *iso*butyryl chloride is difficult to obtain quite free from propionyl chloride, phenyl *iso*propyl ketone, prepared by the Friedel-Crafts’ reaction, is liable to be contaminated with phenyl ethyl ketone, which may be detected by the formation of β-ketonic esters when the ketone is treated with oxalic, formic, phthalic, and other esters in presence of sodium or sodium ethoxide; the pure ketone does not react at all with these esters.

Phenyl *iso*propyl ketoxime, which may be used in purifying the ketone, melts at 94°, and appears to exist in one form only, although previous observers have recorded 58° and 61° respectively as the melting point of the compound.

Whilst inert towards carboxylic esters, phenyl *iso*propyl ketone is acted on by amyl nitrite in the presence of alcoholic sodium ethoxide, yielding acetoxime, ethyl benzoate, and sodium benzoate, the latter doubtless being formed as the result of the presence of water in the alcohol used.

248. "A new stereoisomeride of cyanodihydrocarvone." By Arthur Lapworth and Victor Steele.

d-Carvone unites with hydrogen cyanide in hot alcoholic solution and in the presence of potassium cyanide, yielding a product isomeric with the nitrile obtained at the ordinary temperature (*Trans.*, 1906, **89**, 945 and 1819). It melts at 84°, and has $[\alpha]_D^{11} -42{\cdot}1°$ in absolute alcohol; it shows mutarotation in presence of bases, but the equilibrium point attained corresponds with a rotatory power quite different from that reached by the cyanodihydrocarvone first discovered. As both compounds yield pure *d*-carvone on removal of hydrogen cyanide, the existence of four isomeric nitriles derived from *d*-carvone is indicated by these facts, this number corresponding with that theoretically possible.

249. "The action of hydrogen cyanide on carvone hydrosulphide." By Victor Steele.

Many ketones which contain an ethylenic linking in the $\alpha\beta$-position do not form simple cyanohydrins, but first yield saturated β-cyanoketones, which may subsequently be converted, by union with hydrogen cyanide, into hydroxydicyano-compounds.

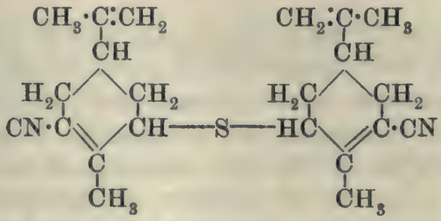
It was thought possible that in certain cases a cyanohydrin of the $\alpha\beta$-hydrochloride might be prepared, from which, by hydrolysis and subsequent removal of the elements of hydrogen chloride, the required unsaturated hydroxy-acid might be obtained. As these operations were not found possible, an analogous series of reactions, involving the use of hydrogen sulphide instead of hydrogen chloride, was examined.

The additive compound of hydrogen sulphide with carvone (Varrentrap, *Handworterbuch d. Chemie*, **4**, 688; Kekulé and Fleischer, *Ber.*, 1873, **6**, 1088) was mixed with one and a-half times its weight of alcohol and two molecular proportions of potassium cyanide dissolved in water, glacial acetic acid being subsequently added until the whole remained but slightly alkaline. To facilitate interaction, 30 c.c. of ether were then added, and the whole left in a corked flask four days at room temperature, when an equal bulk of water was added, and the ethereal solution separated, washed, dried, and evaporated. The residue formed a mass of needles, and was purified by crystallisation from alcohol:

0·1972 gave 0·5422 CO_2 and 0·1414 H_2O. $C=75·0$; $H=8·0$.
0·1704 „ 11·7 c.c. N_2 (moist) at 14° and 760 mm. $N=8·08$.
0·2505 „ 0·1657 $BaSO_4$. $S=9·1$.

$C_{22}H_{28}N_2S$ requires $C=75·0$; $H=8·0$; $N=7·95$; $S=9·09$ per cent.

The compound has therefore been produced by the elimination of the elements of water from the cyanohydrin first formed, and the following formula may therefore be assigned to it:



The compound dissolves fairly readily in the usual solvent media, with the exception of light petroleum, carbon disulphide, and water; it crystallises from alcohol in flat needles, which melt sharply at 94°. It at once discharges the colour of a solution of bromine in chloroform or of potassium permanganate in acetone:

0·4062, made up to 25 c.c. with absolute alcohol, gave, in a 2-dcm. tube, $\alpha +0·16°$, whence $[\alpha]_D^{12} +4·92°$.

In accordance with the absence of hydroxyl groups, the compound is not altered by acetic anhydride or chloride. It readily loses both hydrogen cyanide and hydrogen sulphide when heated with ferrous hydroxide and alkali, but is stable in the cold.

When titrated with a standard solution of bromine in acetic acid in presence of sodium acetate, 0·5 gram used up 0·465 gram of bromine instantaneously, corresponding with 4 atomic proportions of bromine; an additional 0·465 gram was absorbed in the course of thirty minutes, corresponding with a total quantity of 8 atomic proportions of bromine.

The new *dinitrile* is partly hydrolysed when heated for three hours with saturated hydrobromic acid, and an acid product, apparently a mixture, is obtained, contaminated with a neutral oil. The acidic portion of the product finally yielded a small quantity of an apparently pure compound, which melted sharply at 125°:

0·1940 gave 0·4770 CO_2 and 0·1443 H_2O. $C=67·1$; $H=8·2$.
$(C_{10}H_{14}·CO_2H)_2S$ requires $C=67·7$; $H=7·7$ per cent.

0·1438 gram required 7·4 c.c. *N*/10-NaOH for complete neutralisation with phenolphthalein as indicator, whence the equivalent is 194; the value calculated for a dibasic acid, $(C_{10}H_{14}·CO_2H)_2S$, is 195.

The acid is readily soluble in most of the usual media, with the exception of water, carbon disulphide, and light petroleum. It decomposes if heated for a considerable time at 100°, giving a neutral, dark-coloured oil.

250. "Preparation of the nitrites of the primary, secondary, and tertiary ammonium bases." (Preliminary note.) By Pañchānan Neogi.

Small quantities of benzylammonium nitrite (Rây and Datta, *Trans.*, 1911, **99**, 1475), piperidinium nitrite (Neogi, *ibid.*, p. 1599), and triethylammonium nitrite (Neogi, *ibid.*, p. 1253) have been obtained by the distillation and sublimation in a vacuum of a concentrated solution of the hydrochlorides of the bases and the alkali nitrites. The actual isolation of these nitrites from the mixtures leads the author to believe that the reaction between nitrous acid and the primary, secondary, and tertiary amines proceeds through the intermediate stage of a nitrite, which decomposes, in the case of a primary amine to alcohol, in the case of a secondary amine to a nitroso-compound, and in the case of a tertiary amine to the original amine.

251. "Studies of ammonium solutions. Part I. An ammonium electrode." By Roland Edgar Slade.

When hydrogen containing ammonia is passed over platinised platinum in a solution containing ammonium ions, the platinum behaves as an ammonium electrode. The potential of this electrode at 25° depends on the partial pressures of hydrogen and ammonia and on the concentration of ammonium ions in the solution in the following way:

$$e = -0{\cdot}486 - 0{\cdot}059 \log \frac{p_{NH_3}\, p_{H_2}}{[NH_4^{\cdot}]},$$

where $e = e_{\text{electrode}} - e_{\text{solution}}$, and the potential of the normal hydrogen electrode is taken as zero.

Complexes of the form $(NH_3)_xH^{\cdot}$, where x is greater than one, do not exist to any appreciable extent in dilute aqueous ammonia or ammoniacal ammonium chloride solutions, although there is some evidence of their existence at higher concentrations.

252. "The absorption spectra of triketohydrindene hydrate and certain derivatives." By John Edward Purvis.

The results of an investigation of the absorption spectra of triketohydrindene hydrate and its derivatives showed that (1) the colour of the compounds is intimately connected with the presence of ketonic groups; (2) the shade of colour is modified according to the nature of the substituting groups; (3) where another ring is established, there is no selective absorption, and the colour is produced by an extension of the general absorption within the regions of the visible spectrum.

253. "The action of chlorine on alkalis and of carbon dioxide on bleaching powder." By Robert Llewellyn Taylor.

In reply to Higgins' suggestion (*Trans.*, 1911, **99**, 858) that the increased bleaching efficiency of a solution of bleaching powder on the removal of free lime or the addition of chlorides (Taylor, *Trans.*, 1910, **97**, 2541) is not due to the reversal of the action and consequent liberation of chlorine, but, in the first case, to the further action of the carbon dioxide of the air, and, in the second case, to the increased attraction of such solutions for the carbon dioxide of the air, the author pointed out that most of his experiments were performed either in absence of air or with air from which the carbon dioxide had been removed, and described further experiments performed in closed vessels, in which he obtained similar results.

Higgins further stated that other neutral salts of sodium had a similar stimulating effect on the bleaching action of a solution of sodium hypochlorite to the chloride.

Further experiments by the author show that if a solution of sodium hypochlorite contains considerable excess of free alkali, its bleaching action is very slow, and it is not much stimulated by the addition of any sodium salts, but if there is not much free alkali present the stimulating action of sodium chloride is much greater than that of other neutral sodium salts.

The author further pointed out that Higgins' suggested explanation of the action of carbon dioxide on bleaching powder is not really very different from his own. Higgins represents the action by two equations, and the author by three, the second and third of the latter being merely a simplification of Higgins' second.

254. "The relation between residual affinity and chemical constitution. Part II. Certain compounds of nitrogen." By Hans Thacher Clarke.

An account was given of a study of the reactivity towards alcoholic benzyl chloride under standard conditions, and the refractive power of a series of open-chain and cyclic tertiary amines containing one and two nitrogen atoms in the molecule. The conclusion was put forward that derivatives of piperazine display abnormal reactivity and refractive power when compared with the corresponding open-chain compounds. In a series of derivatives of piperidine, it was shown that the reactivity increased similarly when the nitrogen atoms were present in the 1:5-position in a normal chain.

255. "Theory of dyeing: colour and molecular state of picric acid." By William Porter Dreaper.

Picric acid in the anhydrous state is probably colourless. In the presence of moisture it is yellow, and possibly then has a quinonoid structure. In continuation of a previous investigation into the relative inhibiting action of fibre colloids on this colour change (Dreaper and Stokes, *J. Soc. Dyers*, 1909, **25**, 10), the action of toluene on picric acid when present within the fibre area has been examined.

The experimental results indicate that even in the case of cotton, although the change to the colourless type takes place readily in the presence of dehydrating agents, yet the presence of toluene will not bring about this change, in spite of the known fact that picric acid has little affinity for vegetable fibres in the presence of water; also, that under certain conditions picric acid in the yellow state will be adsorbed by cotton from a colourless toluene solution.

256. "Electromotive forces in alcohol. Part II. The hydrogen electrode in alcohol and the influence of water on its electromotive force." By Robert Taylor Hardman and Arthur Lapworth.

Concentration cells reversible to hydrogen ions with solutions of hydrogen chloride in absolute alcohol gave potentials which were constant and reproducible within a fraction of a millivolt. Results with solutions not weaker than $N/20$ were in fairly good agreement with those calculated by employing the transport numbers deduced in Part I (*Trans.*, 1911, **99**, 1420); with lower concentrations, discrepancies of several millivolts were found.

Water depresses the potential of the hydrogen electrode in alcoholic hydrogen chloride, and when the acid is dilute the results indicate a fall in the concentration of the "free" hydrogen ions which is very close to that anticipated on the assumption that the availability of the acid is a measure of this concentration as well as of the catalytic activity of the cations of the acid in a given solvent (*Trans.*, 1908, **93**, 2168, 2190 *et seq.*; 1910, **97**, 23).

With $N/100$-hydrochloric acid in both compartments of such a concentration cell, the potentials observed when water is added to one compartment indicated a "water value" for absolute alcohol = 0·132 at 25°; with $N/500$-hydrochloric acid and $N/10$-lithium chloride to minimise potential differences at the liquid boundary, the "water value" indicated was 0·122 at 25°. These numbers are intermediate between those previously deduced from (i) measurements of the catalytic and (ii) the salt-forming activity of hydrogen chloride in absolute alcohol by Goldschmidt and Udby (0·15) and by Lapworth and Partington (0·10) respectively.

257. "Notes on new coumarin derivatives."
By Arthur Clayton.

In view of the characteristic odour of the 5-nitro-substituted coumarins (Clayton, *Trans.*, 1910, **97**, 1388), the author attempted to prepare 5-nitrocoumarin, since its odour might reasonably be supposed to be stronger than that of the foregoing compounds.

A study of the action of nitric acid on the homologues of coumarin indicated a tendency for the nitro-group to enter position 5 when position 6 is already occupied by a substituent, whence it was hoped that 6-aminocoumarin would yield 5-nitro-6-aminocoumarin when nitrated, and that the amino-group could be subsequently removed by the diazo-reaction.

Preliminary experiments showed that 6-aminocoumarin yielded an unworkable tar when treated with nitric acid, either alone or in solution in acetic or sulphuric acid, but 6-acetylaminocoumarin, when dissolved in nitric acid (D 1·5) cooled to 10°, yielded a solution which, on dilution with water, furnished an abundant and almost white solid. The *nitro-6-acetylaminocoumarin* so obtained crystallised from glacial acetic acid in pale yellow needles, melting at 222—223°:

0·1452 gave 0·2828 CO_2 and 0·0590 H_2O. C = 53·10; H = 4·52.
0·1438 „ 15·1 c.c. N_2 at 21° and 742 mm. N = 11·67.
$C_{11}H_8O_5N_2$ requires C = 53·23; H = 3·23; N = 11·29 per cent.

Nitro-6-acetylaminocoumarin proved to be easily hydrolysed by boiling with sulphuric acid diluted with three times its volume of water for thirty minutes. The product, *nitro-6-aminocoumarin*, was obtained by further dilution with water, and was then crystallised from glacial acetic acid, when orange needles, melting at 238—240°, were obtained:

0·1182 gave 0·2266 CO_2 and 0·0354 H_2O. C=52·31; H=3·36.
0·1432 „ 17·5 c.c. N_2 at 21° and 742 mm. N=13·58.
$C_9H_6O_4N_2$ requires C=52·43; H=2·91; N=13·59 per cent.

All attempts to eliminate the amino-group from the foregoing compound proved unsuccessful, owing to the extreme ease with which *coumarin*-6-*diazo*-5-*oxide* is formed. The latter compound is produced in greatest quantity when nitro-6-aminocoumarin (1 gram) is mixed with absolute alcohol (10 c.c.), and concentrated sulphuric acid (4 to six drops) and an excess of amyl nitrite are consecutively added. On warming, the mixture becomes less pasty, and then, rather suddenly, a mass of crystals is deposited. This product was separated and crystallised from very dilute alcohol, when yellow needles were obtained, melting with abrupt decomposition at 155—160°. It yields no definite product when boiled with acids or alkalis:

0·1468 gave 0·3076 CO_2 and 0·0307 H_2O. C=57·14; H=2·32.
0·1203 „ 15·0 c.c. N_2 at 18° and 770 mm. N=14·60.
$C_9H_4O_3N_2$ requires C=57·45; H=2·13; N=14·89 per cent.

During experiments performed in other directions with the hope of obtaining odorous nitrocoumarins, the following compounds were also obtained.

6-*Methylcoumarin* was prepared by heating together 2-hydroxy-*m*-tolualdehyde (3 grams), anhydrous sodium acetate (3 grams), and acetic anhydride (5 grams) in an oil-bath at 180° for four hours. The product solidified to a brown cake on cooling. This was boiled with water to remove the sodium acetate, and the residue from the cold liquid ground up with methyl alcohol (2 to 3 c.c.). The filtered product was then crystallised, first from dilute methyl alcohol and then from petroleum, after which it formed white needles, melting at 75°. These crystals are somewhat soluble in water, and possess an odour of coumarin:

0·1083 gave 0·2983 CO_2 and 0·0520 H_2O. C=75·11; H=5·34.
$C_{10}H_8O_2$ requires C=75·00; H=5·00 per cent.

Nitro-6-*methylcoumarin* was obtained by dissolving 6-methylcoumarin in concentrated sulphuric acid (20 parts), and adding nitric acid (1 molecule). After twenty minutes, the liquid was poured on ice, and the precipitated solid crystallised from alcohol, when white, inodorous needles, melting at 147—148°, separated:

0·1576 gave 9·6 c.c. N_2 at 23° and 766 mm. N=6·92.
$C_{10}H_7O_4N$ requires N=6·83 per cent.

4 : 8-*Dimethyl*-6-tert.-*butylcoumarin*.—This compound resulted from the condensation of equimolecular quantities of *p*-*tert*.-butyl-*o*-cresol and ethyl acetoacetate in the presence of concentrated

sulphuric acid. White, inodorous needles were obtained, melting at 159—160°:

0·1980 gave 0·5664 CO_2 and 0·1422 H_2O. C = 78·03; H = 7·98.

$C_{15}H_{18}O_2$ requires C = 78·26; H = 7·83 per cent.

The substance appears to behave abnormally toward nitric acid, owing probably to the presence of the *tert.*-butyl group. The nitration product forms white needles, melting at 240—241°, and possesses a pleasant but not very marked odour.

258. "The temperature-coefficient of the electrical conductivity of hydrogen chloride in alcoholic solution." By James Riddick Partington.

The experiments proposed in a former communication (Lapworth and Partington, *Trans.*, 1911, **99**, 1426) are now completed, and the conductivities of alcoholic hydrogen chloride at 0°, 18°, and 25° have been determined.

The values at infinite dilution are found to be:

$$\lambda_\infty \text{ at } 0° = 46·50,$$
$$\lambda_\infty \text{ at } 18° = 60·00,$$
$$\lambda_\infty \text{ at } 25° = 66·50.$$

From these the mean value of the temperature-coefficient, α_∞, is found to be 0·0178 units of λ_∞ at 0° per 1°, and is therefore normal.

259. "The constituents of the oil of Pinus longifolia."

By Henry Haliburton Robinson.

By fractional distillation, the oil of *Pinus longifolia* was found to be divisible into two portions; one portion, amounting to about one-third of the whole, was of a much lower boiling point than the other, and was found to be *l*-pinene. The remaining two-thirds was mainly composed of an oil boiling at 173°, having D_{15}^{15} 0·867 and α_D about +13°. From this, by treatment with dry hydrogen chloride, sylvestrene dihydrochloride was obtained, from which sylvestrene was regenerated. From the mother liquors left after removing as far as possible the sylvestrene dihydrochloride, dipentene was obtained. It is thought very possible that the sylvestrene is not present as such in the original oil, but that a terpene is there contained, which unites with hydrogen chloride to form sylvestrene dihydrochloride, just as pinene yields a hydrochloride from which camphene is obtained when the hydrogen chloride is removed.

260. "The active constituents of the Indian solanaceous plants: Datura Stramonium, D. fastuosa, and D. Metel." By Albert Edward Andrews.

It was found that in the Indian *Datura Stramonium* plants the percentage of total alkaloid in the stems was 0·25; in the leaves, 0·41 to 0·45; and in the fruits, 0·46 per cent.; with one exception this alkaloid consisted of hyoscyamine either alone or associated with a small proportion of scopolamine. The results indicate that the Indian plant bears favourable comparison with the European and Egyptian plants as regards the amount of total alkaloid, but the presence of scopolamine in some of the Indian samples appears to be a point of difference.

In the Indian *Datura fastuosa* samples, the total alkaloid varied from 0·1 in the roots to 0·2 in the fruits, and scopolamine was found to be the predominant alkaloid. In these respects the Indian plant closely resembles the European plant.

In the Indian *Datura Metel* samples the seeds and the leaves contained 0·25, and the capsules 0·12 per cent., of total alkaloid. On comparing the results with those recorded for the European species it appears that in the Indian plant the amount of total alkaloid in the seeds and in the leaves is only about one-half what it is in the European plant, but with one exception the samples resemble the latter in so far that scopolamine is almost unaccompanied by other mydriatic alkaloids.

261. "Contributions to the chemistry of the terpenes. Part X. The action of chromyl chloride, nitrous acid, and nitric acid on bornylene." By George Gerald Henderson and Isidor Morris Heilbron.

On treatment with chromyl chloride dissolved in carbon disulphide, bornylene is converted into a solid *additive product*, $C_{10}H_{16},2CrO_2Cl_2$, which is decomposed by water, giving a *chloroketone*, $C_{10}H_{15}OCl$, and an aldehyde, $C_9H_{15}\cdot CHO$. The ketone, a crystalline solid, m. p. 165°, gives a *semicarbazone*, melting at 234—235°, and yields camphoric acid when oxidised with potassium permanganate, and camphor when heated with alcoholic potassium hydroxide under pressure. It therefore appears to be a new *chlorocamphor*. The aldehyde was proved to be camphenilanaldehyde, a derivative of camphene, which has been prepared in several different ways from that hydrocarbon. The direct formation of this camphene derivative from bornylene indicates close similarity in the molecular structure of these terpenes.

It has been observed that camphenilanic acid, $C_9H_{15}\cdot CO_2H$, can be converted into *iso*camphenilanic acid by repeated crystallisation from water, alcohol, or light petroleum, and also that the semicarbazones obtained from camphenilanaldehyde and *iso*camphenilanaldehyde respectively are identical, and that each yields the *iso*-aldehyde when decomposed with dilute acids.

*Bromo*iso*camphenilanic acid*, a crystalline solid, m. p. 204—205°, was prepared by converting *iso*camphenilanic acid into its *chloride*, $C_9H_{15}\cdot COCl$, a dense liquid, b. p. 118°/25 mm., heating this with bromine under pressure, and decomposing the *chloride* of the *bromo-acid*, $C_9H_{14}Br\cdot COCl$, which is also a heavy, viscous liquid, with water. When warmed with aqueous sodium carbonate, the bromo-acid does not give a corresponding hydroxy-acid, but is converted into an unsaturated acid, $C_9H_{13}\cdot CO_2H$, a colourless, crystalline solid, m. p. 147°.

Bornylene shows a general resemblance to camphene in its behaviour towards nitrous acid, but different products are obtained on attacking these terpenes with nitric acid.

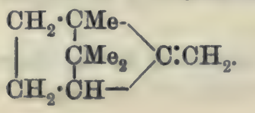
On treatment with nitrous acid, bornylene yields (1) a nitrosite, $(C_{10}H_{16}\cdot N_2O_3)_2$, which crystallises in silky needles, m. p. 163°, and yields camphoric acid on oxidation; (2) an oily, green liquid, which decomposes when heated, dissolves in solutions of alkalis, and is probably an iso*nitrosite*; (3) some camphorquinone; and (4) a very small quantity of a colourless, crystalline *compound*, m. p. 84—85°, which is possibly a nitrite.

When heated with nitric acid, bornylene is, for the most part, oxidised to camphoric acid, but some of it is converted into a yellow, crystalline compound, m. p. 137°, which has the formula $C_{10}H_{16}(NO_2)_2$, and appears to be *dinitrocamphane*. On reduction with alcoholic ammonium sulphide, this substance yields a *compound* which crystallises in yellow needles, m. p. 196—198°, and which apparently is not an amino-derivative. A trace of a colourless, crystalline *compound*, m. p. about 174°, was also found among the oxidation products.

262. "The constitution of camphene."

By George Gerald Henderson and Isidor Morris Heilbron.

Arguments were adduced in support of the view that the constitution of camphene is best represented by the formula:



263. "Candelilla wax."
By James McConnell Sanders.

A sample of Candelilla wax, prepared in the month of January from plants collected in Coahuila, had the appearance of a greenish-white mass with a granular fracture. It contained a considerable proportion of water, and when freed from this, was dark brown, and gave the following values:

Melting point	67·5°
Density	0·9850
Acid value	14·39
Saponification value	46·76
Iodine value (Hübl)	16·60 per cent.
Unsaponifiable matter	77·00 ,,
Hydrocarbons	48·60 ,,

The wax contained hentriacontane and myricyl alcohol.

264. "A convenient method for determining the density of heavy petroleums." By James McConnell Sanders.

Heavy crude petroleums and derived products of similar character, such as the more viscous lubricants, "black oils," etc., present difficulties in manipulation when the determination of their density at the standard temperature is attempted by the usual procedure. In the absence of a knowledge of the coefficient of expansion of a particular sample, it is always desirable to determine the density at a temperature as close to the normal air temperature as possible, this being the more desirable when the data to be obtained are subsequently to be utilised for calculation with large volumes of the commercial article.

Crude petroleums are often so dense and viscous that a determination of the density with the pyknometer is very troublesome, and a very appreciable error is introduced by the presence of suspended water, which cannot be removed easily without employing means which are liable materially to modify the density of the oil.

Filtering through hot anhydrous sodium sulphate, or dry salt, usually results in the loss of the more volatile components of the oil, and the use of the filter pump to facilitate filtration in the cold often gives rise to the same source of error. With increasing density and viscosity of an oil, there is increased difficulty of manipulation and simultaneously increased error from included water.

In the simple method about to be described, the error from suspended water is considerably decreased, although not entirely removed; at the same time, the method possesses the advantage of rapidity and economy in the amount of sample employed.

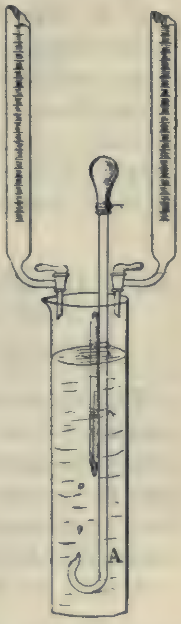
The necessary apparatus consists of a curved glass tube of the form shown, provided with a small rubber bulb or a rubber tube with a pinchcock, according to the density of the oil to be examined. In addition, two graduated burettes of 100 c.c. capacity, a cylinder capable of containing 100 c.c., a thermometer, and a rubber-tipped glass rod.

Two solutions of alcohol and water are required, one containing 0·5 per cent. of alcohol, the other 75 per cent., both by volume. These solutions should be prepared beforehand, and preserved in stoppered stock bottles. The alcohol used should be pure, and the water free from air.

The following method of procedure is to be followed. A well-mixed and representative sample of the oil is poured into the curved glass tube so as nearly to fill it; if the oil is very viscous the small, rubber, pear-shaped cap is used to close the upper orifice of the tube, otherwise the tube and pinchcock are employed.

The burettes are then filled each with one of the alcoholic mixtures, the level of the liquids being brought to the zero point on the burettes, and these are then supported one on each side of the glass cylinder.

The thermometer is then fastened to the filled glass tube in such a manner that its bulb will occupy the central zone of the cylinder when the tube is placed within it so as to rest on the bottom.



About 75 c.c. of the more dilute alcohol are then run into the cylinder from the burette, and the glass tube is immersed in the cylinder. By means of the pinchcock or rubber bulb, a single small drop of the oil is expelled from the lower orifice of the tube, when, if the density of the liquid is greater than that of the oil drop, it will immediately rise to the surface, and can be "fished out" by touching it with the rubber-tipped glass rod. A little of the stronger alcohol is then run in from the other burette, and another trial drop of oil expelled; these operations are repeated until the trial drops begin to rise more slowly and assume a spherical form, showing that the density of the alcohol mixture is approaching that of the oil. When this point is reached, the oil drops should be allowed to exude more slowly, so as to allow any suspended water to be dissolved out by the alcohol, and also to allow the temperature of the alcoholic mixture to coincide with that of the oil in the tube. With a little practice, it is possible to procure a number of oil drops floating in various zones of the alcoholic mixture, when the latter should be well stirred, using the tube and attached thermometer for the purpose. As soon as the densities of the mixture and the oil drops are identical, the volumes of the two alcohols used to form the mixture are read off from the burettes, and the density of the mixture is calculated from the amounts used.

Instead of calculating the density of the mixture (which assumes a previous determination of the density of each dilute alcohol), the mixture may be filtered quickly through moistened cotton wool to separate the oil drops, and the density taken with the hydrometer or the Westphal balance.

A convenient practice consists in preserving the alcoholic mixtures obtained in a series of experiments in closely stoppered bottles, labelled with the corresponding densities and temperatures. These empirical solutions can then be used for approximate determinations of fresh samples of oil.

265. "The probable cause of the elimination of a carbethoxyl group as ethyl carbonate by the action of sodium ethoxide." By Ferdinand Bernard Thole and Jocelyn Field Thorpe.

The cause of the elimination of a carbethoxy-group during the passage of an open-chain nitrile carboxylic ester into a five-ring imino-compound is not due to any condition of strain consequent on the presence of more than one carbethoxy-group on any one carbon atom of the ring, but must be ascribed to a tendency which exists for the compound to acquire the hydrogen atom necessary to enable it to react in its tautomeric form.

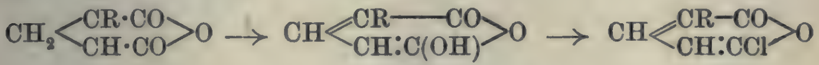
266. "The chemistry of the glutaconic acids. Part II. The reactions of the alkylglutaconic acids having one mobile hydrogen atom." By Ferdinand Bernard Thole and Jocelyn Field Thorpe.

The experiments which have been carried out lead to the following conclusions:

(1) The *α*-monosubstituted derivatives of glutaconic acid are stable in their *trans*-forms, but can be isolated as unstable *cis*-modifications.

(2) The stability of the *cis*-modifications increases with the weight of the group occupying the *α*-position.

(3) The tendency for the mobile hydrogen atom to pass outside the three-carbon system is manifested as soon as ring formation is produced from the *cis*-modification. Thus, the normal anhydride (I) is converted into the hydroxy-anhydride (II) on distillation, and this is transformed into the chloro-anhydride (III) by acetyl chloride:



$$\mathrm{CH_2}\Big<\begin{matrix}\mathrm{CR{\cdot}CO}\\ \mathrm{CH{\cdot}CO}\end{matrix}\Big>\mathrm{O} \longrightarrow \mathrm{CH}\Big<\begin{matrix}\mathrm{CR{-\!-\!-}CO}\\ \mathrm{CH{:}C(OH)}\end{matrix}\Big>\mathrm{O} \longrightarrow \mathrm{CH}\Big<\begin{matrix}\mathrm{CR{-}CO}\\ \mathrm{CH{:}CCl}\end{matrix}\Big>\mathrm{O}$$

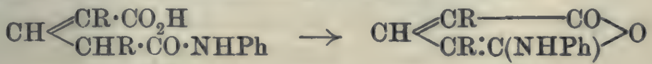
(I.) (II.) (III.)

(4) The anilic acids of the *cis*-modifications pass into the anilic acids of the *trans*-forms when heated.

(5) The di- and tri-substituted derivatives are stable as their *cis*-forms, and cannot be isolated as *trans*-modifications.

(6) The tendency for the mobile hydrogen atom to pass outside the three-carbon system diminishes with the increase of alkyl groups in the molecule.

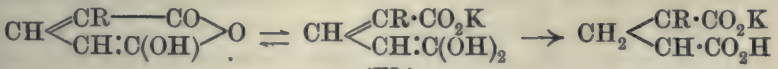
(7) The presence of the mobile hydrogen is indicated, not only by the formation of hydroxy-anhydrides and chloro-anhydrides, but also by the behaviour of the anilic acids (IV), which are converted into anilino-lactones (V) when heated:



$$\mathrm{CH}\Big<\begin{matrix}\mathrm{CR{\cdot}CO_2H}\\ \mathrm{CHR{\cdot}CO{\cdot}NHPh}\end{matrix} \longrightarrow \mathrm{CH}\Big<\begin{matrix}\mathrm{CR{-\!-\!-}CO}\\ \mathrm{CR{:}C(NHPh)}\end{matrix}\Big>\mathrm{O}$$

(IV.) (V.)

(8) The stability of the form which has the hydrogen atom outside the three-carbon system is shown by the fact that the more stable hydroxy-anhydrides behave on titration as monobasic acids, and can be recovered from the solution on acidifying. Analysis of the salts shows them to possess the constitution (VI). It is only when the neutral solution is warmed that the hydrogen passes back into the three-carbon system, yielding the alkali salt of the *cis*-modification:



$$\mathrm{CH}\Big<\begin{matrix}\mathrm{CR{-\!-\!-}CO}\\ \mathrm{CH{:}C(OH)}\end{matrix}\Big>\mathrm{O} \rightleftharpoons \mathrm{CH}\Big<\begin{matrix}\mathrm{CR{\cdot}CO_2K}\\ \mathrm{CH{:}C(OH)_2}\end{matrix} \longrightarrow \mathrm{CH_2}\Big<\begin{matrix}\mathrm{CR{\cdot}CO_2K}\\ \mathrm{CH{\cdot}CO_2H}\end{matrix}$$

(VI.)

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Avogadro, *Amedeo.* Opere scelte. Pubblicate dalla R. Accademia delle Scienze di Torino. pp. cxl + 491. Portrait. Torino 1911. (*Reference.*) From the Academy.

Backer, *Hilmar Johannes*. De Nitraminen en hunne electrochemische reductie tot Hydrazinen. pp. xv + 242. Leiden 1911. (*Recd.* 6/7/11.) From the Author.

Cross, *Charles Frederick*, **Bevan**, *Edward John*, **Sindall**, *Robert Walter*, and **Bacon**, *William N.* Wood pulp and its uses. pp. xi + 270. ill. London 1911. (*Recd.* 19/7/11.) From the Authors.

Friend, *John Albert Newton*. The corrosion of iron and steel. pp. xiv + 300. London 1911. (*Recd.* 27/7/11.)
From the Publishers: Messrs. Longmans, Green and Co.

Graebe, *Carl*. Untersuchungen über Chinone. Edited by *Herman* **Decker**. pp. viii + 672. Portraits. Leipzig 1911. (*Reference.*)
From the Author.

Jago, *William*, and **Jago**, *William C.* The technology of bread-making. Including the chemistry and analytical and practical testing of wheat, flour, and other materials employed in bread-making and confectionery. pp. viii + 908. ill. London 1911. (*Recd.* 28/9/11.)
From the Authors.

Knecht, *Edmund*, **Rawson**, *Christopher*, and **Loewenthal**, *Richard*. A manual of dyeing. 2nd edition. 2 vols. pp. xii + 902. ill. London 1910. (*Recd.* 6/7/11.) From Professor E. Knecht.

Lunge, *George*. [Editor.] Technical methods of chemical analysis. English translation from the latest German edition, adapted to English conditions of manufacture, edited by *Charles Alexander* **Keane**. Vol. II, in two parts. pp. xxvii + 1252. ill. London 1911. (*Recd.* 14/10/11.) From Dr. Charles A. Keane.

Mastin, *John*. The chemistry, properties and tests of precious stones. pp. vi + 114. London 1911. (*Recd.* 14/10/11.)
From the Author.

Mennicke, *Hans*. Die Metallurgie des Wolframs mit besonderer Berücksichtigung der Elektrometallurgie sowie der Verbindungen und Legierungen des Wolframs samt seinen Verwendungen. pp. ii + 416. ill. Berlin 1911. (*Recd.* 11/10/11.)
From the Publisher: M. Krayn.

Menschutkin, *Boris N.* Life and work of N. A. Menschutkin. pp. viii + 376. ill. 1908. [In Russian.] (*Recd.* 21/7/11.)
From Sir William Tilden, F.R.S.

Partington, *J. Riddick*. Higher mathematics for chemical students. pp. iv + 272. London 1911. (*Recd.* 27/7/11.)
From the Publishers: Messrs. Methuen & Co.

Roscoe, *The Right Honourable Sir Henry Enfield*, and **Schorlemmer**, *Carl*. A treatise on chemistry. Vol. I. The non-metallic elements. New edition completely revised by *Sir H. E.* **Roscoe**, assisted by *J. C.* **Cain**. pp. xii + 955. ill. London 1911. (*Reference.*)
From the Right Honourable Sir H. E. Roscoe, F.R.S.

Simmons, *William Herbert,* and **Mitchell,** *Charles Ainsworth.* Edible fats and oils. Their composition, manufacture and analysis. pp. viii + 150. London 1911. (*Recd.* 28/9/11.) From the Authors.

Spencer, *James Frederick.* An experimental course of physical chemistry. Part I. Statical experiments. pp. xiv + 228. ill. London 1911. (*Recd.* 29/9/11.) From the Author.

Zacharias, *Johannes.* Elektrochemische Umformer [Galvanische Elemente]. pp. xii + 262. ill. Wien 1911. (*Recd.* 12/10/11.) From the Publisher : A. Hartleben.

II. *By Purchase.*

Allen, *Alfred Henry.* Commercial organic analysis. Vol. V. 4th edition. Edited by *William Alfred* **Davis** and *Samuel S.* **Sadtler.** pp. ix + 704. London 1911. (*Recd.* 16/10/11.)

Chalon, *Paul F.* Les explosifs modernes. 3rd edition. pp. vi + 789. Paris 1911. (*Recd.* 19/7/11.)

Higgins, *William.* An essay on the theory and practice of bleaching, wherein the sulphuret of lime is recommended as a substitute for pot-ash. pp. xxxii + 71. London 1799. (*Recd.* 16/6/11.)

Scheithauer, *W.* Die Schwelteere, ihre Gewinnung und Verarbeitung. pp. viii + 192. Leipzig 1911. (*Recd.* 25/7/11.)

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, December 4th, 1911.

All persons who received grants in December, 1910, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Friday, December 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

MARCELIN BERTHELOT MEMORIAL LECTURE.

An Extra Meeting will be held on Thursday, November 23rd, 1911, at 8.30 p.m., when the Berthelot Memorial Lecture will be delivered by Professor Harold B. Dixon, M.A., Ph.D., F.R.S.

ERRATA.

PROCEEDINGS, 1911.

Page	Line	
184	10	*after* "many" *insert* "other."
191	8*	*for* "β-5-hydroxy-3-methoxyphenylethylamine" *read* "β-5-hydroxy-3-methoxyphenylpropionic acid."

* From below.

At the next Ordinary Scientific Meeting on **Thursday**, November **2nd, 1911**, at **8.30** p.m., the following papers will be communicated:

"The constituents of the seeds of *Casimiroa Edulis*." By F. B. Power and T. Callan.

"Preparation of the betaine of tryptophan, and its identity with the alkaloid hypaphorine." By P. von Romburgh and G. Barger.

"β-2-Methoxynaphthylpropionic acid and methoxy-*peri*-naphthindanone." By G. Barger and W. W. Starling.

"Dihydroxydihydrindylamine and its resolution into optically active components." By W. J. Pope and J. Read.

"Studies in phototropy and thermotropy. Part II. Naphthylideneamines." By A. Senier and R. Clarke.

"Some derivatives of 4-(or 5)-methylglyoxaline." By A. J. Ewins.

"The stability of the double oxalates of sodium and nickel, and sodium and cobalt." By J. W. Dodgson.

"The lower limit of inflammation of mixtures of the para hydrocarbons with air." By M. J. Burgess and R. V. Wheeler.

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[*Issued* 10/11/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 391.

Thursday, November 2nd, 1911, at 8.30 p.m., Dr. M. O. Forster, D.Sc., Ph.D., F.R.S., Vice-President, in the Chair.

Certificates were read for the first time in favour of Messrs.:

John Henry Garner, B.Sc., Sewage Works, Deighton, Huddersfield.
Rufus Gauut, M.Sc., Ph.D., 70, Abingdon Villas, Kensington, W.
Sant Ram Khosla, near City Kotwali, Lahore, India.
Harold King, M.Sc., 161, Altmore Avenue, East Ham, E.
Geoffrey Martin, M.Sc., Ph.D., 4, Bertram Road, Hendon, N.W.
George Alfred Stokes, 60, Parkhill Road, Hampstead, N.W.

Of the following papers, those marked * were read:

*267. "The constituents of the seeds of Casimiroa edulis."

By Frederick Belding Power and Thomas Callan.

The material employed for this investigation consisted of the sh seeds of *Casimiroa edulis,* La Llave and Lejarza (Nat. Ord. *taceae*), which were obtained directly from Mexico.

The kernels of the seed, representing about four-fifths of the weight of the entire material, gave abundant reactions for an alkaloid, and were found to contain an enzyme which slowly hydrolysed amygdalin.

An alcoholic extract of the kernels, when distilled in a current of steam, yielded a small amount of a pale yellow essential oil, which possessed an aromatic odour and the following constants: D^{20} 0·9574; α_D $-2°25'$ in a 25 mm. tube.

From the portion of the extract which was soluble in water there were isolated: (1) a new alkaloid, *casimiroine*, $C_{24}H_{20}O_8N_2$ (m. p. 196—197°), which on heating with alkalis undergoes hydrolysis with the elimination of carbon dioxide, yielding a new base, *casimiroitine*, $C_{23}H_{22}O_7N_2$ (m. p. 171°); (2) a new alkaloid, *casimiroedine*, $C_{17}H_{24}O_5N_2$ (m. p. 222—223°); (3) benzoic acid, with apparently a trace of salicylic acid. The aqueous liquid contained, furthermore, a quantity of sugar, which yielded *d*-phenylglucosazone (m. p. 205—207°).

The portion of the extract which was insoluble in water consisted of a soft, oily resin, from which the following compounds were isolated: (1) sitosterol, $C_{27}H_{46}O$; (2) ipuranol, $C_{23}H_{38}O_2(OH)_2$; (3) a mixture of fatty acids; (4) a new lactone, *casimirolid*, $C_{24}H_{28}O_6$ (m. p. 229—230°), which yields a new hydroxy-acid, designated as *casimiroic acid*, $C_{23}H_{28}O_4(OH)\cdot CO_2H$ (m. p. 207°), of which the *silver* salt, *methyl* ester, and *acetyl* derivative were prepared; (5) a yellow, phenolic *substance*, $C_{16}H_{12}O_6$ (m. p. 215—218°).

The hypnotic or toxic properties attributed to *Casimiroa* seed could not be confirmed by physiological tests.

*268. "Preparation of the betaine of tryptophan and its identity with the alkaloid hypaphorine." By Pieter van Romburgh and George Barger.

The betaine $C_{14}H_{18}O_2N_2$ has been obtained by the methylation of tryptophan, and has been proved to be identical with the naturally occurring alkaloid hypaphorine. The intermediate compound, $C_{15}H_{21}O_2N_2I$, which is formed is the quaternary *iodide* of *methyl α-trimethylamino-β-indolepropionate*, glistening plates, m. p. 197°.

*269. "β-2-Methoxynaphthylpropionic acid and methoxy*peri*naphthhydrindone." By George Barger and Walter William Starling.

Experiments were carried out with the object of adding a third six-membered ring to naphthalene by introducing a chain of three carbon atoms joining two *peri*-positions (compare Sachs and Brigl, *Ber.*, 1911, **44**, 2091). The following new substances were described: *β-2-methoxynaphthylacrylic acid*,

$$CH_3\cdot O\cdot C_{10}H_6\cdot CH{:}CH\cdot CO_2H,$$

m. p. 160°; *β-2-methoxynaphthylpropionic acid*,

$$CH_3\cdot O\cdot C_{10}H_6\cdot CH_2\cdot CH_2\cdot CO_2H,$$

m. p. 128°; and *methoxy*peri*naphth-hydrindone*, $C_{14}H_{12}O_2$, deep yellow crystals, b. p. 210°/12 mm., m. p. 135°.

*270. "Some derivatives of 4(or 5)-methylglyoxaline." By Arthur James Ewins.

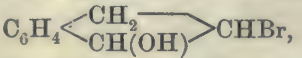
By heating 4(or 5)-methylglyoxaline with formaldehyde to 120°, an additive product, 4(or 5)-*methyl*-5(or 4)-*hydroxymethylglyoxaline*, m. p. 138°, is formed. When treated with phosphoryl chloride, this compound yields 4(or 5)-*methyl*-5(or 4)-*chloromethylglyoxaline*. The latter can be converted into 4(or 5)-*methyl*-5(or 4)-*cyanomethylglyoxaline*, m. p. 163—164°, which on reduction yields 4(or 5)-*methyl*-5(or 4)-*β-aminoethylglyoxaline*, a new base which was found to be physiologically active, having a marked vaso-dilator effect.

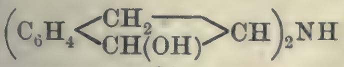
By the action of ammonia and methylamine respectively on 4(or 5)-methyl-5(or 4)-chloromethylglyoxaline were obtained 4(or 5)-*methyl*-5(or 4)-*aminomethylglyoxaline* and 4(or 5)-*methyl*-5(or 4)-*methylaminomethylglyoxaline*. These compounds were, however, physiologically inactive.

*271. "Studies in the camphane series. Part XXX. Constitution of pernitrosocamphor (camphenylnitroamine)." By Martin Onslow Forster, John Robert Trotter, and Jacob Weintroube.

From experiments with pernitrosocamphor and its potassium derivative, the authors were led to put forward new formulæ for these compounds.

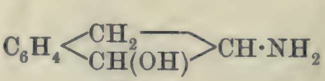
272. "Dihydroxydihydrindamine and its resolution into optically active components." By William Jackson Pope and John Read.

Improved methods were described for the preparation of bromohydroxyhydrindene,  $C_6H_4<\begin{array}{l}CH_2\text{——}\\CH(OH)\end{array}>CHBr$, and its conversion into *dihydroxydihydrindamine* (I) and 1-*hydroxy*-2-*hydrindamine* (II):



$$\left(C_6H_4<\begin{array}{l}CH_2\text{——}\\CH(OH)\end{array}>CH\right)_2NH$$

(I.)



$$C_6H_4<\begin{array}{l}CH_2\text{——}\\CH(OH)\end{array}>CH{\cdot}NH_2$$

(II.)

The resolution of dihydroxydihydrindamine into its optically active components by means of *d*-camphor-*β*-sulphonic acid was described.

273. "Studies in phototropy and thermotropy. Part II. Naphthylideneamines." By Alfred Senier and Rosalind Clarke.

The Schiff's bases obtained by the condensation of 2-hydroxy-α-naphthaldehyde with various aromatic amines have been studied in order to see if these compounds, which contain the hydroxyl radicle in the ortho-position with respect to the group ·CH⁚NR in the naphthalene ring, exhibit phototropy or thermotropy in the same manner as previous experience had shown to be the case with analogous benzene derivatives.

The naphthylideneamines in question are obtained by the interaction of 2-hydroxy-α-naphthaldehyde with the following amines: *o*-, *m*-, and *p*-chloroanilines, *o*-, *m*-, and *p*-bromoanilines, *m*-nitroaniline, *o*-, *m*-, and *p*-aminophenols, *o*-, *m*-, and *p*-anisidines, *o*-, *m*-, and *p*-aminobenzoic acids, *o*-4-, *m*-4-, and *p*-xylidines, and ψ-cumidine. None of these bases proved to be phototropic, but all exhibit thermotropy.

274. "The stability of the double oxalates of sodium and nickel, and sodium and cobalt." By John Wallis Dodgson.

On boiling nickel oxalate, $NiC_2O_4,2H_2O$, with an approximately 2*N*-solution of sodium carbonate, a green solution is obtained; when this is filtered from the residue, and allowed to remain for about twenty-four hours, green crystals separate, which consist of the double oxalate of sodium and nickel, with but a small amount of impurity. The green solution cannot be crystallised by evaporation aided by heat, as the salt is partly decomposed on heating with water or with sodium carbonate solution, forming a pale green precipitate, but leaving a solution still green in colour. The green solution is also obtained when sodium oxalate and nickel oxalate are boiled together with water, and also when nickel carbonate is boiled with sodium oxalate solution, but in the latter case crystals do not form easily.

Three specimens of the crystalline compound were prepared, one (*a*) by boiling 20 grams of nickel oxalate with 100 c.c. of a 2*N*-solution of sodium carbonate, another (*b*) by boiling 15 grams of nickel oxalate with 100 c.c. of a 4*N*-solution of sodium carbonate, and a third (*c*) by boiling sodium oxalate and nickel oxalate in molecular proportions with water. A green solution was obtained in each case; it was filtered, and allowed to remain for a few days, when the crystals separated, and were washed several times with cold water and dried in the air. On analysis:

(*a*) Found Ni = 13·68; Na = 10·41; C_2O_4 = 41·18; H_2O = 34·73.*
(*b*) „ Ni = 13·62; Na = 10·83; C_2O_4 = 41·18; H_2O = 34·37.*
(*c*) „ Ni = 13·77; Na = 10·79; C_2O_4 = 41·43; H_2O = 34·01.*
$Na_2C_2O_4,NiC_2O_4,8H_2O$ requires Ni = 13·82; Na = 10·83; C_2O_4 = 41·44; H_2O = 33·91 per cent.

The results agree sufficiently closely with one another to warrant the conclusion that the same compound is formed in each case, and that its composition is properly expressed by the formula

$$Na_2C_2O_4,NiC_2O_4,8H_2O.$$

In order to test the effect of a large excess of carbonate, 100 c.c. of a 4*N*-solution of sodium carbonate were boiled with three grams of nickel oxalate; a pale green solution was obtained, from which no crystals separated after five days; later sodium carbonate crystallised out, leaving the solution still green. This result agrees with that obtained on boiling the double oxalate with a solution of sodium carbonate.

The reaction which takes place is obviously a balanced reaction, and may be represented by the equation:

$$Na_2CO_3 + 2NiC_2O_4 \rightleftharpoons Na_2C_2O_4,NiC_2O_4 + NiCO_3,$$

the actual conditions of equilibrium depending on the relative masses of the sodium carbonate and nickel oxalate reacting.

As, however, the most interesting case is that of the action of a 2*N*-solution of sodium carbonate, 5 grams of nickel oxalate were boiled with 50 c.c. of 2*N*-sodium carbonate, the liquid filtered while hot, the residue thoroughly washed with successive quantities of cold water, and the filtrate and washings diluted to half a litre. Analysis showed that this contained 2·2 grams of C_2O_4 and 0·245 gram of nickel; these amounts are 87·5 per cent. of the C_2O_4, and 15·2 per cent. of the nickel in the nickel oxalate taken. The residue left on the filter was found to contain oxalate.

Cobalt oxalate, $CoC_2O_4,2H_2O$, is decomposed in a similar manner, but the amount of double oxalate produced is not so great. Five grams of cobalt oxalate were boiled with 50 c.c. of 2*N*-sodium carbonate, and filtered and washed. The filtrate was found to contain 2·37 grams of C_2O_4 and 0·117 gram of cobalt; in this case practically all the C_2O_4 in the original oxalate enters into solution, but only 7·3 per cent. of the cobalt, as compared with 15 per cent. of the nickel. The residue consisted entirely of carbonate.

The double oxalate of cobalt and sodium is easily prepared by boiling together cobalt oxalate and sodium oxalate with water. The pink solution deposits crystals on keeping, which on analysis gave the following result:

* By difference.

Found: Co $=$ 13·89; $C_2O_4 = 41{\cdot}18$.

$Na_2C_2O_4,CoC_2O_4,8H_2O$ requires Co $= 13{\cdot}88$; $C_2O_4 = 41{\cdot}41$ per cent.

It is therefore obvious that neither nickel oxalate nor cobalt oxalate can be completely converted into carbonate by the action of a sodium carbonate solution, and that in each case a soluble double oxalate is formed, having the composition given by the formulæ already deduced, this double salt being stable in the presence of excess of sodium oxalate.

275. "The lower limit of inflammation of mixtures of the paraffin hydrocarbons with air." By Maurice John Burgess and Richard Vernon Wheeler.

The conditions under which self-propagation of flame can take place in mixtures of inflammable gases and air were discussed. The authors find that the smallest quantity of pure methane that will enable self-propagation of flame to take place when a source of heat is introduced into a mixture of it with air is 5·6 per cent. by volume of the mixture. That is to say, the "lower-limit mixture" contains 5·6 per cent. of methane.

It was shown that for the paraffin hydrocarbons the lower limit of inflammation varies inversely as the calorific value of the gas. Thus, if L = the proportion of the paraffin hydrocarbon necessary to form a lower-limit mixture, and C = its calorific value,

$$L = f(1/c)\text{; or, say, } L = k1/c,$$

where k is a constant.

Using methane as the standard to obtain the value of k, the observed and calculated values of L are as follows:

Gas.	L observed.		L calculated.
Methane	5·60	standard	5·60
Ethane	3·10		3·15
Propane..................	2·17		2·19
n-Butane	1·65		1·68
n-Pentane...............	1·37		1·36
*iso*Pentane	1·32		1·36

276. "Formation of six- and seven-membered rings from derivatives of 2 : 2′-ditolyl." By James Kenner and Emily Gertrude Turner.

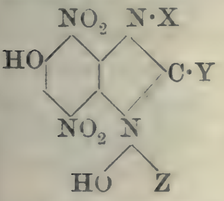
Continuing their studies on the cyclic condensation of derivatives of 2 : 2′-ditolyl, which have been shown to lead to the formation of phenanthrene (this vol., p. 92), the authors have found that 2 : 2′-dialdehydodiphenyl is converted by the action of concentrated potassium hydroxide solution into *ω-hydroxy-2-methyldiphenyl-2′-carboxylic acid*, m. p. 146°, from which an *ε-lactone*, m. p. 132°, is obtained by heating it at 110°.

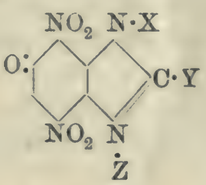
2 : 2′-*Ditolyl*-ωω′-*dicarboxylonitrile* undergoes condensation under the influence of sodium ethoxide, with formation of 1-*imino*-2-*cyano*-3 : 5-*dibenzo*-$\Delta^{3:5}$-cyclo*heptadiene*, m. p. 189°. This substance is hydrolysed by sulphuric acid, with formation of 1-*imino*-3 : 5-*dibenzo*-$\Delta^{3:5}$-cyclo*heptadiene*-2-*carboxylic acid*, m. p. 180°, which yields 3 : 5-*dibenzo*-$\Delta^{3:5}$-cyclo*heptadien*-1-*one*, m. p. 78—79°, by further hydrolysis with dilute acid.

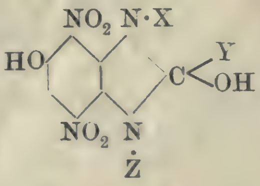
277. "Syntheses with phenol derivatives containing a mobile nitro-group. Part V. Quinoneimides, asymmetric quaternary ammonium compounds, and asymmetric carbinols (continued)."

By Raphael Meldola and Harold Kuntzen.

The authors gave further proof of the general applicability of their method of synthesising dinitroiminazolium compounds, iminazolones, and iminazolols. A series of new compounds was described, in which the radicles X and Y in the formulæ given below had been varied:







In the new series X represented phenyl, *p*-anisyl, *p*-chlorophenyl and benzyl; Y = ethyl and *iso*butyl, and Z = methyl. A further consideration of possible formulæ for the quinoneimidonium compounds led the authors to maintain the correctness of their original view as expressed by the formulæ adopted. It was pointed out that the quinquevalent nitrogen atom in these compounds was comparable with that contained in compounds of the oxyammonium type, $O{:}N(R)_3$, the highly acid quinonoid radicle representing the oxygen atom. Independent evidence of the existence of such quinoneimidonium compounds had been obtained in the course of a further study of the product of the extreme methylation of *iso*picramic acid (*Proc.*, 1910, **26**, 232), and the authors stated that this research was in progress.

278. "Isomeric acetaldehydephenylhydrazones."

By Ernyst Graham Laws and Nevil Vincent Sidgwick.

Lockemann and Liesche's work on this subject has been repeated and confirmed in more detail. The hydrazone was prepared by the interaction of acetaldehyde and phenylhydrazine in aqueous alcohol.

The product is a mixture of the two isomerides. The α-form, m p. 98·6°, is obtained by recrystallisation from alkaline aqueous alcohol, and the β, m. p. 56·6°, by recrystallisation from acidified aqueous alcohol. Aqueous and gaseous alkalis and acids cause the isomeric change without the hydrazone passing into solution, and without any apparent change in the crystals themselves.

The freezing-point curve has been obtained, and shows that the two isomerides form a continuous series of mixed crystals (solid solutions). The crystals of the two forms appear to be identical, and they have the same density. The influence of a solvent is to give an equilibrium mixture containing about 75 per cent. of the α-form. The hydrazone can be distilled in a vacuum, and the isomerides pass over at temperatures 100° apart.

The peculiarity of the isomerism must be connected with the small difference in the relative stability of the two forms. On the other hand, there is no doubt that the α-modification is more stable in the presence of alkali, and the β- in the presence of acid, and that a trace of alkali or acid can bring about a change proceeding through a mass of crystals without their passing into solution. It therefore follows that there is a difference between crystals in contact with acid and crystals in contact with alkali. This can only come about by adsorption of acid or alkali into the crystals, which causes a difference in energy greater than the difference between the two absolutely pure forms.

279. "Nitrites of the alkylammonium series. Part IV. Triethylammonium nitrite and its decomposition and sublimation by heat." By Prafulla Chandra Rây and Jitendra Nath Rakshit.

Triethylammonium nitrite is obtained by the interaction of triethylamine hydrochloride and silver nitrite in aqueous solution and evaporation of the filtrate in a vacuum over sulphuric acid. The salt crystallises in pale yellow tablets and prisms. When heated it decomposes into triethylamine, alcohol, and ether, nitric oxide, nitrous oxide, and nitrogen being evolved; at the same time a portion of it sublimes unchanged.

280. "The formation of dichlorocarbamide and its behaviour towards amines." By Rasik Lal Datta.

In the preparation of dichlorocarbamide, Chattaway (*Proc. Roy. Soc.*, 1908, **81**, 381) ascribed the small yield which he obtained to the hydrolysis of the compound by the acid liberated in the reaction. It has now been found that during the formation of dichlorocarbamide, carbamide hydrochloride is produced, which diminishes the yield, being itself incapable of chlorination. The action of bromine on carbamide has been studied, and the results seem to point to the formation of dibromocarbamide in solution. The behaviour of amines with dichlorocarbamide has also been investigated, the result being the formation of chloroamines, with or without the evolution of gas.

281. "Synthetical experiments in the group of the *iso*quinoline alkaloids. Part II. The constitution of the condensation products of cotarnine and the condensation of cotarnine with aliphatic and aromatic nitro-compounds." By Edward Hope and Robert Robinson.

An account was given of the condensation of cotarnine with nitromethane, and with a number of derivatives of nitrotoluene: *o*- and *p*-nitrotoluene condense in the presence of sodium ethoxide, whilst nitromethane, di- and tri-nitrotoluenes, and also trinitroxylene and trinitromesitylene condense in the absence of any agent.

282. "The synthesis of derivatives of thioxanthone. Part IV. Synthesis from aromatic sulphinic acids." By Harold Christopher and Samuel Smiles.

It was shown that derivatives of thioxanthone may be obtained by heating together a sulphinic acid with a *m*-hydroxy- or amino-benzoic acid. A few typical examples of this synthetical method were given. From benzenesulphinic acid and *m*-aminobenzoic acid 2-aminothioxanthone was obtained, whilst *o*- and *p*-toluenesulphinic acids with *m*-amino- or hydroxy-benzoic acid yielded the corresponding amino- or hydroxy-thioxanthones. Hydroxythioxanthone, prepared by another method, was also investigated.

283. "Komppa's synthesis of camphoric acid."
By Gustave Louis Blanc and Jocelyn Field Thorpe.

The authors find that when methyl diketocamphorate is hydrolysed by very dilute alkali, that is, under conditions comparable with those used by Komppa in his synthesis of camphoric acid, the methyl group remains attached to carbon. Their criticism of this synthesis is therefore baseless.

284. “The electrochemistry of solutions in acetone. Part I.” By Alexander Roshdestwensky and William Cudmore McCullagh Lewis.

The object of the experiments was to find if the Nernst expressions for the electromotive forces of concentration cells hold good in acetone solution. Conductivity measurements were carried out in the case of lithium nitrate and silver nitrate in order to determine the ionic concentration values required for the calculation of the cell $\mathrm{Ag}\left|\underset{C_1}{\mathrm{AgNO_3}}:\underset{C_2}{\mathrm{AgNO_3}}\right|\mathrm{Ag}$, which includes in its simple form a liquid | liquid potential difference, and also for the calculation of *E.M.F.*'s when attempts are made to remove the liquid | liquid potential difference. The results obtained on comparing calculated and found values support the view that the simple osmotic formulæ are applicable.

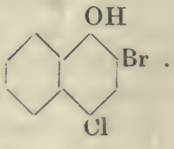
285. “Chlorination of α-naphthol by acetylchloroamino-2 : 4-dichlorobenzene.” By Harold King.

With the exception of Kast's (*Ber.*, 1911, **44**, 1337) recent preparation of 4-chloro-α-naphthol by the use of sulphuryl chloride, the four known monochloro-α-naphthols have only been obtained by indirect methods.

In investigating the direct chlorination of α-naphthol, the author has used the method described by Orton and King (*Trans.*, 1911, **99**, 1185). The naphthol is treated in glacial acetic acid solution with a molecular proportion of acetylchloroamino-2 : 4-dichlorobenzene and 1/100th of a gram-molecular proportion of hydrochloric acid, whereby the concentration of the chlorine set free is kept at a low value. The chlorination is rapid, and unaccompanied by oxidation. The diluted acetic acid solution is extracted with chloroform, and the latter removed by a current of warm air. The chlorinated product is separated from the accompanying dichloroacetanilide by extraction with a 2 per cent. sodium hydroxide solution, and a single crystallisation from light petroleum (b. p. 60—85°) gives a 40 to 50 per cent. yield of almost pure 4-chloro-α-naphthol. The exceedingly soluble residue *A*, recovered from the petroleum mother liquor, corresponds in melting point and properties with the so-called monochloronaphthol of Claus and Oehler (*Ber.*, 1882, **15**, 312), Cleve (*Ber.*, 1888, **21**, 891), and Kalle & Co. (D.R.-P. 167458). By fractional precipitation from alkaline solution by dilute mineral acid, a very partial separation into substances of different acidity takes place. [Cleve (*loc. cit.*) could obtain no pure product in this way.] Nevertheless, the first 25 per cent. precipitated when recrystallised from dilute acetic acid yields hexagonal, scaly crystals of α-naphthol.

2 : 4-Dichloro-α-naphthol, crystallising in needles, can be obtained in quantity from *A* by repeated crystallisation from dilute acetic acid containing 10 to 20 per cent. of water. No indication of the presence of other monochloro-α-naphthols in the mixture was observed, and hence, if present, they must be very small in amount. It is seen, therefore, that the composition of the initial chlorinated product approximates to 50 per cent. of 4-chloro-α-naphthol, 30 per cent. of dichloro-α-naphthol, and 20 per cent. of α-naphthol, the two latter obviously being present in equimolecular proportions. The determination of the melting-point curve for mixtures of α-naphthol and dichloro-α-naphthol afforded additional evidence that the soluble residue *A* consisted of equimolecular proportions of α-naphthol and dichloro-α-naphthol, with a very small quantity of 4-chloro-α-naphthol.

4-Chloro-α-naphthyl benzoate, $C_{10}H_6Cl\cdot OBz$ (m. p. 99—100°; Autenrieth and Mühlinghaus, *Ber.*, 1907, **40**, 748, give 100—101°), was obtained by benzoylation of 4-chloro-α-naphthol. It is readily soluble in all the ordinary organic solvents, except light petroleum. (Found, Cl = 12·46. Calc., Cl = 12·55 per cent.)

4-*Chloro*-2-*bromo*-α-*naphthol*,  .

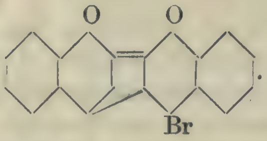
By bromination of 4-chloro-α-naphthol in acetic acid solution, 4-*chloro*-2-*bromo*-α-*naphthol* was obtained. It crystallises from benzene in lustrous, white needles, melting at 94—95°. It is very readily soluble in the common organic solvents. From acetic acid it separates in glassy prisms, containing acetic acid, which become opaque, and disintegrate on the water-bath:

0·1990 gave 0·2559 AgCl + AgBr. Cl + Br = 44·81.

$C_{10}H_6OClBr$ requires Cl + Br = 44·82 per cent.

Its constitution was proved by oxidation with fuming nitric acid, whereby 2-bromo-α-naphthaquinone and Liebermann and Schlossberg's β-dinaphthyl-α-diquinone (*Ber.*, 1899, **32**, 548) were obtained.

4-Chloro-2-bromo-α-naphthol resembles 2 : 4-dichloro- and 2 : 4-dibromo-α-naphthol in its behaviour towards alkalis. On exposure of its solution in alkalis to sunlight, it is quantitatively converted into a deep blue, insoluble substance, which still contains bromine. The fact that the ortho-bromine atom is not displaced is not in harmony with Bruncke's formula (*Diss.*, Marburg, 1903) for the corresponding compound obtained from dibromo-*a*-naphthol:



Preparation of 2:4-*Dichloro-a-naphthol*.—The employment of two molecular proportions of acetylchloroamino-2:4-dichlorobenzene to one of *a*-naphthol serves as a quantitative method of obtaining dichloro-*a*-naphthol free from tri- and penta-chloroketonaphthalenes which are formed when a current of chlorine is used for the chlorination.

ADDITIONS TO THE LIBRARY.

III. *Pamphlets.*

Beveridge, *Wilfred William Ogilvy.* A report on the determination of the amount of tin in tinplate used for canning preserved food. (From the *J. Roy. Army Med. Corps*, 1911.)

Bock, *Johannes.* Über die Ausscheidung der Alkalimetalle bei der Purindiurese. (From the *Skand. Arch. Physiol.*, 1911, **25**.)

Brauns, *Dirk Hendrik.* Theory of the rotation of the plane of polarisation. pp. 21. Detroit 1911.

Contino, A. Sulla quantità di manganese in alcuni terreni Italiani. (From the *Staz. sper. agrar. ital.*, 1911, **44**.)

Gross, *Oscar.* Untersuchungen über das Verhältniss von Stickstoff zu Schwefel im Stoffwechsel. (From the *Zeitsch. exp. Path. Ther.*, 1911, **9**.)

Heiduschka, *Alfred*, and **Biéchy**, *Theodor.* Bestimmung des Arsens im Harn nach Anwendung von Salvarsan. (From the *Apoth. Zeit.*, 1911.)

Kraft, *F.* Die Glykoside der Blätter der Digitalis purpurea. (From the *Schweiz. Wochensch. Chem. Pharm.*, 1911.)

Lange, *Hans.* Studien über die Zusammensetzung heliumführender Mineralien. (From the *Zeitsch. Naturwiss. Halle*, 1910, **82**.)

Masoni, *Giulio.* Saggio sull' azione del solfato di Manganese in rapporto alla vegetazione. (From the *Staz. sper. agrar. ital.*, 1911, **44**.)

Mingaye, *John C. H.*, and **White**, *Harold P.* Analyses of artesian and sub-artesian waters in New South Wales. pp. 8. Sydney 1911.

Paderi, *Cesare*. Richerche sulle proprietà biologiche dell' acido glicuronico. I. (From the *Arch. Farm. sperim. Sci.*, 1911, **11**.)

Piccinini, *Guido M.* Il metabolismo del manganese e la legge del minimo tra manganese e ferro. (From the *Arch. Farm. sperim. Sci.*, 1910, **10**.)

—— Il manganese come attivatore o cinasi non specifica e il Manganese colloidale. (From the *Biochem. Terap. sperim.*, 1910, **2**.)

Prandi, *Oreste*, and **Civetta**, *Angelo*. Il manganese nel vino. (From the *Staz. sper. agrar. ital.*, 1911, **44**.)

Shepherd, *Ernest S.*, and **Rankin**, *George A.* Preliminary report on the ternary system $CaO-Al_2O_3-SiO_2$. A study of the constitution of Portland cement clinker. With optical study by *Fred. E.* **Wright**. (From the *J. Ind. Eng. Chem.*, 1911, **3**.)

Sundwik, *Ernst Edw.* Xanthinstoffe aus Harnsäure. (From the *Skand. Arch. Physiol.*, 1911, **25**.)

Thunberg, *Torsten*. Studien über die Beeinflussung des Gasaustausches des überlebenden Froschmuskels durch verschiedene Stoffe. X. (From the *Skand. Arch. Physiol.*, 1911, **25**.)

Tigerstedt, *Robert*. Zur Kenntnis der Aschebestandteile in der frei gewählten Kost des Menschen. (From the *Skand. Arch. Physiol.*, 1910, **24**.)

Venturoli, *Giuseppe*, and **Gallerani**, *Guido Tartarini*. Contributo allo studio chimico-tossicologico dell' Adrenalina. (From the *Giorn. Farm. Chim.*, 1911, **60**.)

Walter, *Johann*. Einige Notizen über die zwischen aromatischen Amino- und Nitrokörpern auftretenden Färbungen. (From the *Zeitsch. Farb.-Ind.*, 1911.)

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, December 4th, 1911.

All persons who received grants in December, 1910, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Friday, December 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

MARCELIN BERTHELOT MEMORIAL LECTURE.

An Extra Meeting will be held on Thursday, November 23rd, 1911, at 8.30 p.m., when the Berthelot Memorial Lecture will be delivered by Professor Harold B. Dixon, M.A., Ph.D., F.R.S.

At the next Ordinary Scientific Meeting on **Thursday**, November **16th**, 1911, at **8.30** p.m., the following papers will be communicated:

"The influence of neutral solvents on velocity of reaction. Part I. Transformation of anis*syn*aldoxime in various solvents." By T. S. Patterson and H. H. Montgomerie.

"Organic derivatives of antimony. Part II. The orienting influence of antimonic substituents in the benzene nucleus." By G. T. Morgan and Miss F. M. G. Micklethwait.

"Chemical examination of calabar beans." By A. H. Salway.

"Copper salts and their behaviour with alkalis." By S. U. Pickering.

"Contributions to the chemistry of the terpenes. Part XII. Synthesis of a menthadiene from thymol, and of a diethyl*cyclo*hexadiene from phenol." By G. G. Henderson and R. Boyd.

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[Issued 29/11/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 392.

Thursday, November 16th, 1911, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Mr. R. W. Merriman was formally admitted a Fellow of the Society.

The PRESIDENT read the following letter:

HOME OFFICE,
WHITEHALL.
July 24th, 1911.

SIR,

I am commanded by the King to convey to you hereby His Majesty's thanks for the Loyal and Dutiful Address of the President, Council, and Fellows of the Chemical Society on the occasion of Their Majesties' Coronation.

I am, Sir,
Your obedient servant,
(*Signed*) WINSTON S. CHURCHILL.

To the Hon. Secretaries,
The Chemical Society,
Burlington House,
London, W.

The PRESIDENT made the following statements:

(*a*) An Address had been presented, on behalf of the Society, to the Royal Academy of Sciences of Turin, on the occasion of the centenary commemoration of Amedeo Avogadro:

THE CHEMICAL SOCIETY
TO
THE ROYAL ACADEMY OF SCIENCES OF TURIN.

GREETING,

We, the President and Officers, desire on behalf of the Chemical Society to associate ourselves with you in doing honour to the memory of your illustrious compatriot, Amedeo Avogadro.

Of all the pillars upon which the edifice of modern chemistry is supported there is assuredly none more fundamental, excepting the atomic theory, than the famous and illuminating hypothesis formulated one hundred years since by Avogadro. It would be difficult to exaggerate the indebtedness of Chemical Science to the great Italian Physicist, whose inspired fancy penetrated so deeply into the mysteries of the gaseous state of matter that he was able to reveal its ultimate and quantitative structure to the world.

We would take the opportunity of this Centenary Commemoration to congratulate Italy, not only on this magnificent conception of Avogadro, but also on its far-reaching fructification nearly fifty years later through the genius of Stanislao Cannizzaro.

Signed on behalf of the Chemical Society:

PERCY F. FRANKLAND, *President.*
ALEXANDER SCOTT, *Treasurer.*
G. T. MORGAN } *Honorary*
ARTHUR W. CROSSLEY } *Secretaries.*
HORACE T. BROWN, *Foreign Secretary.*

Dated this Twentieth Day of July, One Thousand Nine Hundred and Eleven.

(*b*) A Committee had been formed with the object of raising funds for the purpose of erecting a memorial to the memory of Jacobus Henricus van't Hoff, who died on March 1st, 1911. It is proposed to erect a statue of van't Hoff in Amsterdam, where he carried out most of his teaching work, and made most of his important discoveries. Further, to found an "International van't Hoff Institution," from the funds of which Institution scientific investigations will be supported.

Subscriptions may be sent to the Treasurer of the Society (Dr. A. Scott).

(*c*) A communication has been received from Professor A. Haller stating that it is proposed to raise a memorial to the late Professor Paul Schützenberger, and inviting subscriptions to the fund, which should be sent to M. Emile Blondel, 2, rue Ampère, Rouen.

Certificates were read for the first time in favour of Messrs.:

Thomas Sharp Dick, 15, South Street, Greenock, N.B.
Harold Forster Dodson, 6, Lune Street, Saltburn-by-the-Sea.
Ernest George Gaul, M.Sc., The College, Holmes Chapel, Cheshire.
Herbert Middleton, M.Sc., 7, Howard Street, Horton Lane, Bradford.

Certificates have been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Messrs.:

Charles Christian Gardthausen, Assistant Curator, Geological Survey, Pretoria.
James Hogan Hill, c/o Opium Agent, Ghazipur, U.P., India.
Gaston Nilié-Martin, S. African Sugar Refineries, Ltd., South Coast Junction, Natal.
John Ffraid Richardson, Government Quinine Factory, Mungpu, P.O., Sonada, D.H. Railway, India.
Alexey Mïkhaïlovich Vassiliev, The University, Kasan, Russia.

Of the following papers, those marked * were read:

*286. "Chemical examination of Calabar beans."
By Arthur Henry Salway.

In connexion with the preparation of a quantity of the alkaloid physostigmine (eserine), the opportunity was taken for a more complete examination of the other constituents of Calabar beans. The physostigmine, $C_{15}H_{21}O_2N_3$, thus obtained melted at 86—87°, whereas the recorded melting point of this alkaloid is 105—106°, which was found to agree with a pure commercial specimen of physostigmine. This discrepancy was proved to be due to the fact that the alkaloid is dimorphous. In addition to the above alkaloid, the following compounds were isolated: A new alkaloid, *physovenine*, $C_{14}H_{18}O_3N_2$ (m. p. 123°); a new dihydric alcohol, *calabarol*, $C_{23}H_{36}O_4$ (m. p. 245°), which yields a *dibenzoyl* derivative, melting at 195—196°; trifolianol, $C_{21}H_{36}O_4$; and palmitic, stearic, behenic, oleic, and linolic acids. A considerable amount of sugar was also present, which yielded *d*-phenylglucosazone (m. p. 205°). The alkaloid eseramine (m. p. 245°) and the compounds designated as stigmasterol, $C_{30}H_{48}O$, and sitosterol, $C_{27}H_{46}O$, which had previously been isolated from Calabar beans, were also obtained. It was, however, not found possible to confirm the statements respecting the presence in Calabar beans of the alkaloids designated a "eseridine" and "*iso*physostigmine" respectively.

DISCUSSION.

Dr. VELEY inquired if the author had studied any physiologica properties of his purified samples of physostigmine (eserine) or its salts, such as the hydrochloride or hydrobromide. Having regard to the poisonous properties of the Calabar bean, from which the base is obtained, experiments on the effects on isolated muscle or nerve of the constituent base would be of especial importance in medico-legal cases.

Dr. SALWAY stated that the new alkaloid physovenine, $C_{14}H_{18}O_3N_2$, possessed powerful myotic properties, being similar in this respect to physostigmine, but that its physiological action had not been further determined.

*287. "Organic derivatives of antimony. Part II. The orienting influence of antimonic substituents in the benzene nucleus."

By Gilbert T. Morgan and Frances M. G. Micklethwait.

When treated with a mixture of concentrated nitric and sulphuric acids, phenylstibinic acid, diphenylstibinic acid, and triphenylstilbine hydroxynitrate yield nitro-derivatives containing one nitro-group in each benzene nucleus present in the molecule. The orientation of these nitro-groups with respect to the antimonic radicles was determined by suspending the nitro-compounds in dry chloroform, and heating with a mixture of phosphorus pentabromide and bromine at 120—140°. These reagents bring about the replacement of antimony by bromine, the fission products being 1-bromo-3-nitrobenzene and antimony bromide. The presence of quinquevalent antimony in the benzene ring determines the introduction of a nitro-group in accordance with the meta-law of substitution.

m-*Nitrophenylstibinic acid*, $NO_2\cdot C_6H_4\cdot SbO(OH)_2$, *di*-m-*nitrodiphenylstibinic acid*, $(NO_2\cdot C_6H_4)_2SbO\cdot OH$, and *tri*-m-*nitrotriphenylstibinic acid*, $(NO_2\cdot C_6H_4)_3Sb(OH)_2$, are sparingly soluble, yellowish-white, amorphous compounds, yielding soluble alkali salts. The reduction of the last of these acids leads to the formation of *tri*-m-*aminotriphenylstibine* $(NH_2\cdot C_6H_4)_3Sb$.

The prolonged interaction of triphenylstibine and antimony chloride in xylene solution at 240° results in the formation of diphenylstibine chloride and phenylstibine dichloride:

$$2Ph_3Sb + 4SbCl_3 = 3Ph_2SbCl + 3SbCl_3 \rightleftharpoons 6PhSbCl_2$$

(compare Hasenbäumer, *Ber.*, 1898, **31**, 2911; Michaelis and Gunther, *Ber.*, 1911, **44**, 2316).

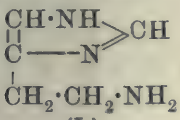
Discussion.

Dr. Pyman pointed out that Ehrlich and Bertheim (*Ber.*, 1907, **40**, 3297) proved the orientation of *p*-aminophenylarsinic acid by converting it into *p*-iodoaniline by boiling with sulphuric acid and potassium iodide, and inquired whether the authors had tried this method on their aminophenylstibinic acids.

Dr. Morgan replied that the method had been tried, but had proved to be inapplicable in the case of the antimony compounds dealt with.

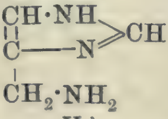
*288. "Aminoalkylglyoxalines." By Frank Lee Pyman.

For comparison of their physiological activity with that of 4(or 5)-β-aminoethylglyoxaline (I), several aminoalkylglyoxalines have been prepared:



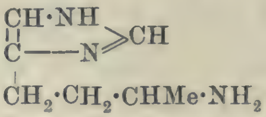
$$\begin{array}{l}\mathrm{CH{\cdot}NH}\\ \| \qquad\qquad >\mathrm{CH}\\ \mathrm{C{-}{-}{-}N}\\ |\\ \mathrm{CH_2{\cdot}CH_2{\cdot}NH_2}\end{array}$$

(I.)



$$\begin{array}{l}\mathrm{CH{\cdot}NH}\\ \| \qquad\qquad >\mathrm{CH}\\ \mathrm{C{-}{-}{-}N}\\ |\\ \mathrm{CH_2{\cdot}NH_2}\end{array}$$

(II.)



$$\begin{array}{l}\mathrm{CH{\cdot}NH}\\ \| \qquad\qquad >\mathrm{CH}\\ \mathrm{C{-}{-}{-}N}\\ |\\ \mathrm{CH_2{\cdot}CH_2{\cdot}CHMe{\cdot}NH_2}\end{array}$$

(III.)

4(or 5)-Aminomethylglyoxaline (II) was obtained by the oxidation of 2-thiol-4(or 5)-aminomethylglyoxaline with ferric chloride.

γ-*Amino*-4(or 5)-*butylglyoxaline* (III) was formed on the reduction of the oxime of γ-*keto*-4(or 5)-*butylglyoxaline*,

$$C_3H_3N_2{\cdot}CH_2{\cdot}CH_2{\cdot}COMe,$$

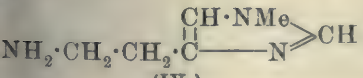
a base resulting from the hydrolysis of ethyl 4(or 5)-glyoxalinemethylacetoacetate.

βγ-*Bis*[4(or 5)-*glyoxaline*]*propylamine*,

$$C_3H_3N_2{\cdot}CH_2{\cdot}CH(CH_2{\cdot}NH_2){\cdot}C_3H_3N_2,$$

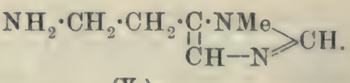
resulted from the reduction of αβ-bis[4(or 5)-glyoxaline]propionitrile.

1-*Methyl*-4-β-*aminoethylglyoxaline* (IV) and 1-*methyl*-5-β-*aminoethylglyoxaline* (V) were prepared by reducing 1-*methyl*-4-*cyanomethylglyoxaline* and 1-*methyl*-5-*cyanomethylglyoxaline* respectively, the two isomerides produced by methylating 4(or 5)-cyanomethylglyoxaline:



$$\begin{array}{l}\qquad\qquad\qquad\quad\ \mathrm{CH{\cdot}NMe}\\ \qquad\qquad\qquad\quad\ \| \qquad\qquad\quad >\mathrm{CH}\\ \mathrm{NH_2{\cdot}CH_2{\cdot}CH_2{\cdot}C{-}{-}{-}{-}N}\end{array}$$

(IV.)



$$\begin{array}{l}\mathrm{NH_2{\cdot}CH_2{\cdot}CH_2{\cdot}C{\cdot}NMe}\\ \qquad\qquad\qquad\quad\ \| \qquad\qquad >\mathrm{CH.}\\ \qquad\qquad\qquad\quad\ \mathrm{CH{-}N}\end{array}$$

(V.)

289. "The influence of neutral solvents on velocity of reaction. Part I. Transformation of aniss*yn*aldoxime in various solvents." By Thomas Stewart Patterson and Harvey Hugh Montgomerie.

The influence of various neutral solvents on the rate of transformation of aniss*yn*aldoxime in the presence of ethyl tartrate was described, the results being discussed in connexion with other work of a similar character.

290. "Copper salts and their behaviour with alkalis." By Spencer Umfreville Pickering.

Copper salts of organic acids containing no alcoholic hydroxyl react with alkalis to form insoluble basic salts, whilst those of the oxy-acids form soluble cupri-compounds, either of the *cis*- or *trans*-description; in some cases a certain amount of basic salt is also formed. *trans*-Cupri-salts of monobasic acids are, in nearly every case, very unstable.

Further evidence that copper in cupri-salts is present as CuO, and not as copper displacing hydrogen, was obtained in several cases, especially in that of the salicylate and malate, the latter being of importance, because the compound in question must be of the *cis*-type, and former evidence applied chiefly to compounds of the *trans*-type.

In the case of copper glycerate, a cupri-compound has been obtained, differing in composition from the normal salt only by the elements of water, but certainly not being a mere hydrate. The two compounds have very different solubilities, colours, and decomposition temperatures; and in solution the cupri-compound may easily be converted into the normal salt.

Thirteen basic salts precipitated by alkali from salts of acids containing no alcoholic hydroxyl conform to formulæ representing 1, 3, or 7CuO united with a molecule of the normal salt. Besides these, about twenty new compounds have been obtained.

291. "Contributions to the chemistry of the terpenes. Part XII. Synthesis of a menthadiene from thymol, and of a diethyl*cyclo*hexadiene from phenol." By George Gerald Henderson and Robert Boyd.

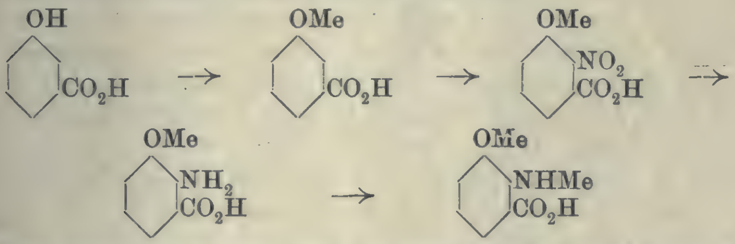
Thymomenthol (hexahydrothymol), $C_{10}H_{19}\cdot OH$, obtained by hydrogenating thymol according to Sabatier and Senderens' method, when heated with anhydrous oxalic acid yields as an intermediate product *thymomenthyl oxalate*, a crystalline solid, melting at 90°, and finally Δ^3-menthene, $C_{10}H_{18}$. This hydrocarbon unites with bromine to form an oily dibromide, $C_{10}H_{18}Br_2$, which when heated with alcoholic potassium hydroxide yields a menthadiene, $C_{10}H_{16}$, probably the $\Delta^{2:4}$-isomeride, a liquid which boils at 173—174°.

3:5-Diethylphenol, prepared synthetically from phenol, is converted into 1:3-*diethyl*cyclo*hexan*-5-*ol*, $C_{10}H_{19}\cdot OH$, a liquid boiling at 203—205° when heated with hydrogen in presence of nickel. When dehydrated with anhydrous oxalic acid, the latter compound yields 1:3-*diethyl*-Δ^4-cyclo*hexene*, $C_{10}H_{18}$, a liquid which boils at 163—166°, and unites with bromine, forming an oily *dibromide*, $C_{10}H_{18}Br_2$. On treatment with alcoholic potassium hydroxide, the dibromide yields a 1:3-*diethyl*cyclo*hexadiene*, $C_{10}H_{16}$, probably the $\Delta^{3:5}$-isomeride, a liquid which boils at 166—168°, and resembles in several respects the monocyclic terpenes.

292. "The synthesis of damasceninic acid (2-methylamino-3-methoxybenzoic acid)." (Preliminary note.) By Arthur James Ewins.

The alkaloid damascenine is readily converted into the isomeric damasceninic acid (Pommerehne, *Arch. Pharm.*, 1900, **238**, 531). The latter was shown to be 2-methylamino-3-methoxybenzoic acid by Keller, who unsuccessfully attempted its synthesis from methylanthranilic acid (*Arch. Pharm.*, 1908, **246**, 1).

The acid has now been synthesised from *m*-hydroxybenzoic acid by a series of reactions represented as follows:



Since damasceninic acid can be reconverted into the original alkaloid (Keller, *loc. cit.*), the synthesis of the latter is virtually accomplished.

293. "The oxidation of camphene with hydrogen peroxide." (A correction.) By George Gerald Henderson and Maggie Millen Jeffs Sutherland.

Geh. Rat Professor Dr. Bredt has pointed out to the authors what they had unfortunately overlooked, that the name "camphylic acid" which they proposed for the acid $C_{10}H_{16}O_2$ (m. p. 95°), obtained by oxidising camphene with hydrogen peroxide (Henderson and Sutherland, *Trans.*, 1911, **99**, 1539), has already been applied by Perkin to the acid which he prepared by fusing sulphocamphylic acid with potassium hydroxide. Professor Aschan has also informed the authors that he has found an acid which apparently is identical with theirs among the products of the oxidation of camphene with potassium permanganate in acetic acid at a low temperature, and he suggests for it the name "camphenanic acid." As this name is very appropriate, the authors are glad to adopt the suggestion, and to designate the acid melting at 95° *camphenanic* instead of *camphylic* acid.

294. "Note on the preparation of labile benzaldehydephenylhydrazone." By Ferdinand Bernard Thole.

Thiele and Pickard have shown (*Ber.*, 1898, **31**, 1250) that ordinary benzaldehydephenylhydrazone is converted into a labile form when its suspension in acetic anhydride is treated with concentrated sulphuric acid and the resulting solution is poured into water. The author has experienced some difficulty in obtaining this product in a crystalline condition, but a good yield of the labile isomeride has been obtained by the method recently described (Dunstan and Thole, this vol., p. 233) for the preparation of *syn*-oximes.

Powdered benzaldehydephenylhydrazone is suspended in concentrated hydrochloric acid, and hydrogen chloride passed in to saturation. The resulting red suspension when poured into excess of sodium carbonate gives a bulky, yellowish-white precipitate of the labile phenylhydrazone. The product crystallises readily from glacial acetic acid, and is evidently identical with that described by Thiele and Pickard (Found, $N=14{\cdot}30$. Calc., $N=14{\cdot}29$ per cent.). It melts at 136°, is very soluble in the ordinary organic solvents, and on repeated crystallisation is slowly transformed into the stable modification (m. p. 152°).

The substance is evidently not identical with the azo-compound, $C_6H_5{\cdot}CH_2{\cdot}N{:}N{\cdot}C_6H_5$, which has been recently described as a yellow oil (*Annalen*, 1910, **376**, 265).

When the stable modification is moistened with ether and exposed to a current of dry hydrogen chloride, it assumes an orange-red colour, and an increase in weight is obtained approximating to that demanded by the addition of two molecular proportions of hydrogen chloride. Attempts are being made to prepare other labile isomerides by the method described above.

295. "The separation of mixtures of organic acids by partial esterification." By John Joseph Sudborough and Ebenezer Rees Thomas.

The authors are able to show that mixtures of the following types: an αβ-unsaturated acid and its saturated analogue; an αβ-unsaturated acid and the βγ-isomeride; an αβ-unsaturated acid and the γδ-isomeride, can be readily separated by partial esterification, using the catalytic method. Under suitable conditions the separation is practically complete after one treatment with alcoholic hydrogen chloride. The method possesses many advantages over Fittig's method of separating mixtures of αβ- and βγ-unsaturated acids, more particularly as both acids can be recovered.

296. "Preparation of the ketones of the higher fatty acids." By Thomas Hill Easterfield and Clara Millicent Taylor.

The authors find that the ketones of the saturated higher fatty acids are very conveniently prepared by heating the acids with about one-tenth their weight of cast-iron turnings to a temperature of about 360°. The method gives good results with the acids from lauric to melissic. Stearic acid gives an 80 per cent. yield of stearone.

The unsaturated acids oleic, elaidic, and brassidic also yield ketones when heated with metallic iron, but the yield is not so good as in the case of the saturated acids. Oleone was shown to be present in commercial "distillation" oleic acid. The method does not give satisfactory results with acetic, butyric, phenylacetic, benzoic, suberic, or sebacic acids.

The following new compounds were described: *Diheptadecylcarbinol*, m. p. 89·5°, and its *acetate*, m. p. 56—61°. *Cerotoneoxime*, m. p. 78°. *Dipentacosylcarbinol*, m. p. 95°, and its *acetate*, m. p. 58—60°. *Montanone*, $C_{55}H_{110}O$, m. p. 97°, and its *oxime*, m. p. 82·5°. The corresponding secondary *alcohol*, $C_{55}H_{112}O$, m. p. 101°, and its *acetate*, m. p. 66°. *Melissone*, m. p. 99·5°, and its *oxime*, m. p. 84°. *Oleone*, $C_{35}H_{66}O$, m. p. 59°, and its *oxime*, m. p. 31°. *Elaidone*, m. p. 70°, and its *oxime*, m. p. 32°. *Brassidone*, m. p. 80°, and its *oxime*, m. p. 51°. The ketone of erucic acid was not obtained in a pure state.

297. "Complex thio-oxalates." By Charles Stanley Robinson and Humphrey Owen Jones.

In a former paper (Jones and Tasker, *Trans.*, 1909, **95**, 1904) it was shown that solutions of potassium dithio-oxalate gave an intense magenta colour with a solution of a nickel salt and an intense brown with a cobalt salt; these colours were still visible in solutions containing 1 part of the metal in 40,000,000 parts of water. The behaviour of these solutions indicated the presence of a complex salt, and the authors have now prepared several of these complex salts and others containing palladium or rhodium.

The salts derived from nickel, palladium, and iron have the general formula $M''(COS)_4M'_2$. Potassium, sodium, ammonium, barium, lead, aniline, and phenyltrimethylammonium salts of nickelo-dithio-oxalic acid have been prepared. The molecular weights in solution and the electrical conductivities show that these salts are derived from a dibasic acid.

The salts containing cobalt or rhodium correspond with the formula $M'''(COS)_6M'_3$; determinations of molecular weight and electrical conductivities show that these are derived from a tribasic acid.

Aqueous solutions of nickelo-dithio-oxalic acid have been prepared, and have nearly the same conductivity as equivalent solutions of sulphuric acid, so that this acid is about as strong as sulphuric acid. These solutions decompose gradually on keeping.

298. "The absorption spectra of various iodine derivatives of benzene and toluene as vapours, in solution and in thin films."

By John Edward Purvis.

The results proved that, in the ultra-violet regions, neither the vapours nor the alcoholic solutions, nor the thin films of iodobenzene, *o*- and *m*-iodotoluene, and *o*- and *m*-di-iodobenzene exhibited any bands of selective absorption, which had been found previously in the corresponding chlorine and bromine compounds under similar physical conditions, although the number of bands in the latter compounds is decreased as the weight and type of the substituted atom or group of atoms is increased. The phenomena were discussed from a consideration of the heavier iodine atom still further damping and dislocating the vibrations, so that the rhythmical oscillations or vibrations are destroyed, and no selective absorption is possible.

299. "The transformation of ammonium cyanate into carbamide."

By Frederick Daniel Chattaway.

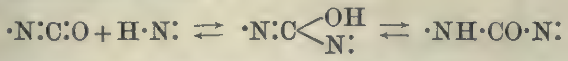
The course of the reaction which takes place when ammonium cyanate is transformed into carbamide has never been satisfactorily explained.

Up to a few years ago it was universally regarded as a peculiar case of isomeric change, and no consideration was given to the process by which the conversion is effected.

A review of the evidence leads to the conclusion that the explanation put forward by Walker and his co-workers is not correct, and that in the transformation, ammonium and cyanic ions play directly no part.

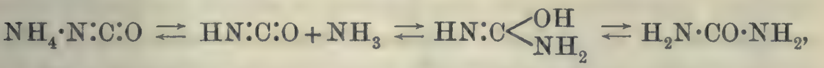
The change of non-electrolytically dissociated ammonium cyanate into carbamide appears to be a simple process only until the atomic readjustments consequent upon it are considered. It is then seen that if it is to be regarded as an intramolecular rearrangement, it is altogether unusual and exceptional.

The production of carbamide from ammonium cyanate and a large number of other reactions of allied compounds can be brought into harmony if they are regarded as instances of the well-known tendency of the carbonyl group to combine with groups such as R_2NH or $R\cdot OH$, followed by subsequent atomic rearrangements involving only the transference of a hydrogen atom from an oxygen atom to a nitrogen atom, doubly linked to the carbon atom with which it is associated, thus:



$$\cdot\mathrm{N{:}C{:}O}+\mathrm{H\cdot N{:}} \rightleftharpoons \cdot\mathrm{N{:}C}{<}\begin{matrix}\mathrm{OH}\\ \mathrm{N{:}}\end{matrix} \rightleftharpoons \cdot\mathrm{NH\cdot CO\cdot N{:}}$$

The conversion of ammonium cyanate into carbamide should therefore be formulated as follows:



$$\mathrm{NH_4\cdot N{:}C{:}O} \rightleftharpoons \mathrm{HN{:}C{:}O}+\mathrm{NH_3} \rightleftharpoons \mathrm{HN{:}C}{<}\begin{matrix}\mathrm{OH}\\ \mathrm{NH_2}\end{matrix} \rightleftharpoons \mathrm{H_2N\cdot CO\cdot NH_2},$$

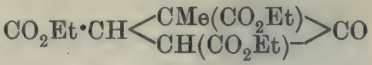
What has hitherto been regarded as the oldest and best known example of isomeric change is therefore not a case of isomeric change at all, but a reaction between cyanic acid and ammonia exactly analogous to the reactions between *iso*cyanic esters and ammonia or amines, whereby substituted carbamides are formed.

300. "The condensation of ethyl citraconate with ethyl sodiomalonate. Formation of *cyclo*pentanone-4-carboxylic acid." (Preliminary note.) By Edward Hope.

This condensation has been previously examined by several investigators with widely differing results (Michael, *J. pr. Chem.*, 1887, [ii], **35**, 354; Auwers, Köbner, and v. Meyenburg, *Ber.*, 1891, **24**, 2893; Michael and Schulthess, *J. pr. Chem.*, 1892, [ii], **45**, 57; Ruhemann and Cunnington, *Trans.*, 1898, **73**, 1010; Michael, *Ber.*, 1900, **33**, 3757). As was first pointed out by Michael (*Ber.*, 1900, **33**, 3757), the solvent employed has an extraordinary influence on the course of the interaction. In ethereal solution, condensation occurs, according to Michael, in the normal manner, with the production of ethyl β-methylpropane-αβγγ-tetracarboxylate (I), but in alcoholic solution the *cyclo*butane derivative (II) is supposed to be produced:

$CO_2Et\cdot CH_2\cdot CMe(CO_2Et)\cdot CH(CO_2Et)_2$

(I.)



$$CO_2Et\cdot CH<\begin{matrix}CMe(CO_2Et)\\ CH(CO_2Et)-\end{matrix}>CO$$

(II.)

The importance of such a simple method for synthesising *cyclo*butane derivatives led the present author to examine the reaction more closely with the object, if possible, of extending its application. It was found, however, that the above assumptions regarding the course of the reaction were erroneous. In ether or benzene solution, ethyl citraconate and the sodium derivative of ethyl malonate yield ethyl butane-ααβγ-tetracarboxylate (III), because

$CO_2Et\cdot CHMe\cdot CH(CO_2Et)\cdot CH(CO_2Et)_2$

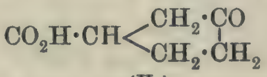
(III.)

$CO_2Et\cdot CH_2\cdot CH(CO_2Et)\cdot CH_2\cdot CH(CO_2Et)_2$

(IV.)

on hydrolysis this ester (III) gives a mixture of the well-known stereoisomeric butane-αβγ-tricarboxylic acids (m. p. 186° and 148—152° respectively).

In alcoholic solution the nature of the product depends on the temperature at which the reaction is conducted. At the ordinary temperature the main product is ethyl butane-ααβδ-tetracarboxylate (IV), probably produced by the isomerisation of ethyl citraconate to ethyl itaconate, followed by the condensation of the latter with ethyl sodiomalonate in the normal manner. At the temperature of the steam-bath, however, the ethyl butane-ααβδ-tetracarboxylate first produced undergoes internal condensation, with the formation of a *cyclo*pentane derivative. From the product of the reaction a keto-acid was obtained (m. p. 60—62°), which gave a semicarbazone (m. p. 196—198°) and an oxime (m. p. 177—179°).* This acid was compared directly, and found to be identical with the *cyclo*pentanone-4-carboxylic acid (V) described by Kay and Perkin (*Trans.*, 1906, **89**, 1646):



$$CO_2H\cdot CH<\begin{matrix}CH_2\cdot CO\\ \qquad\quad|\\ CH_2\cdot CH_2\end{matrix}$$

(V.)

It seems clear that the substance (I) is not formed in the above condensation, because the author has been unable to isolate even traces of β-methyltricarballylic acid from the products of hydrolysis, and, indeed, this acid, which the author hopes to prepare, is at present unknown.

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* The m.p. of this oxime is erroneously given by Kay and Perkin as 141°, instead of 177—179°.

The author is also engaged in the further investigation of the mechanism of the formation of cyclic substances in reactions similar to that represented above.

301. "The relative activities of certain organic iodo-compounds." (Preliminary note.) By David Segaller.

The reactivities of some alkyl iodides with sodium phenoxide in alcoholic solution have been measured. The author finds in this reaction a normal decrease of the velocity constant with increase in molecular weight. The following iodides have been investigated: methyl, ethyl, propyl, *iso*propyl, butyl, *iso*butyl, *tert.*-butyl, *iso*amyl, *tert.*-amyl, hexyl. An abnormal result is obtained in the case of *iso*propyl iodide. Measurements are being made at various temperatures, and the investigation is being extended to other iodides and iodo-derivatives.

302. "Some α'-derivatives of camphor." By James Ernest Marsh.

When bromine acts on camphor mercuribromide, $C_{10}H_{15}O,HgBr$, the main product besides mercury bromide is α'-bromocamphor. Hence in the monomercuri-derivatives of camphor the mercury occupies the α'-position. The author has shown (*Trans.*, 1910, **97**, 240) that in the dimercuri-compounds the $\alpha\alpha'$-position is occupied by the mercury. When therefore the mono- are obtained from the di-derivatives the mercury in the α-position is replaced by hydrogen, whilst that in the α'-position remains. The production of α'-bromocamphor in another way, and its properties have been already described by the author (*Trans.*, 1890, **57**, 528). Whereas the crystals of ordinary α-bromocamphor show double refraction, Mr. T. V. Barker has found that α'-bromocamphor gives singly refracting crystals.

303. "The velocity of addition of alkyl bromides to cyclic tertiary bases." By Frank Stevenson Long.

The rates at which various alkyl bromides, especially *iso*amyl, *iso*butyl, and *iso*propyl bromides, combine with pyridine, α- and β-picolines, and quinoline in amyl-alcoholic solution have been determined at 92·6°.

It was found that *iso*amyl bromide reacts, on the average, seven times, and *iso*propyl bromide three times, more rapidly than *iso*butyl bromide. These results, on comparison with those of other workers, seem to indicate that *iso*propyl compounds, owing to their secondary nature, are not strictly comparable with *iso*butyl and *iso*amyl compounds, since with some reagents they are more, and with others less, reactive than the other alkyl bromides. Except for this there is manifested considerable regularity explicable on steric hypotheses.

304. "The essential oil of Origanum hirtum, Link." (Preliminary note.) By Samuel Shrowder Pickles.

The *Origanum* oils are mostly obtained from countries bordering on the Mediterranean, and the two chief varieties known in commerce are (1) Trieste origanum oil, and (2) Smyrna origanum oil. It has long been assumed that the former is the product of *O. hirtum*, Link, and an oil was examined by Jahns in 1879 (*Arch. Pharm.*, 1879, **215**, 1) which was obtained from a plant identified by Grisebach as *O. hirtum*, Lk. This oil consisted mostly of carvacrol, no thymol being found in it.

Early in the present year a consignment of herb described as "Origanum Plant" was received at the Imperial Institute from the Trieste Commercial Museum. Specimens of this material were identified at the Royal Gardens, Kew, as *O. hirtum*, Link. On chemical examination, however, the phenolic constituents of the oil obtained from this plant by distillation with steam were found to consist almost entirely of thymol, carvacrol being apparently absent.

The dry plant yielded 3·3 per cent. of a pale yellow oil, which possessed a pronounced odour of thymol and a burning taste. It gave the following results on examination: D^{15} 0·9440, α_D (in 100 mm. tube) $+0°24'$. The oil was soluble to a clear solution in 2·8 parts of 70 per cent. alcohol. An estimation of the phenols present by absorption in dilute sodium hydroxide solution gave 64·4 per cent. by volume, equivalent to 66—67 per cent. by weight.

A determination of the thymol present by conversion of the latter into its iodine derivation gave 68·4 per cent. of thymol (by weight). On seeding the original oil with a crystal of pure thymol, it rapidly deposited large quantities of this substance in beautiful crystals and in an approximately pure condition. The phenolic portion of the oil separated by means of sodium hydroxide solidified completely. Traces of another phenolic substance which gave a deep red coloration with ferric chloride were also observed.

This oil appears to be very similar to one recently examined by Schimmel & Co. (*Report*, October, 1911, p. 63).

305. "The essential oil of Dalmatian white thyme." (Preliminary note.) By Samuel Shrowder Pickles.

A supply of this herb has recently been received at the Imperial Institute from the Commercial Museum of Trieste. Specimens of the plant were submitted to the Royal Gardens, Kew, for botanical examination, and it was there identified as *Satureia*, sp., possibly one of the many forms of *S. montana*, Linn., which is often difficult to distinguish from *S. cuneifolia*, Tenore.

The dry herb, when distilled in a current of steam, yielded 1·64 per cent. of an oil possessing the characteristic odour of carvacrol. It had a sharp, burning taste, and a golden-yellow colour. The oil had D_{15}^{15} 0·9548, α_D $-1°3'$, and contained 68·75 per cent. of phenolic constituents, mostly carvacrol (nitroso-compound, m. p. 153—154°). The oil was soluble to a clear solution in 2·7 parts of 70 per cent. alcohol. The non-phenolic constituents of the oil are under examination.

This oil appears to be very similar to one recently examined by Schimmel & Co. (*Report*, October, 1911, p. 109).

306. "The molecular configuration of 1-methyl*cyclo*hexylidene-4-acetic acid and of the oxime of *cyclo*hexanone-4-carboxylic acid." By Arthur Ernest Everest.

In their paper on "Optically active derivatives of 1-methyl*cyclo*hexylidene-4-acetic acid" (*Trans.*, 1911, **99**, 1510) Perkin and Pope summararily dismiss the points raised by the author (*Chem. News*, 1909, **100**, 295) regarding the correctness of their view (Perkin, Pope, and Wallach, *Trans.*, 1909, **95**, 1789) that the compound under discussion contains no asymmetric carbon atom.

In view of the fact that the matter is of some considerable importance—Perkin and Pope in their paper (*ibid.*, p. 1511) say: "The discovery of the new type of optically active substances referred to involves a considerable extension of the whole subject of stereochemistry"—the author feels that a few further words on the subject will not be out of place.

From the outset the author wishes to point out that, as has already been mentioned in the Chemical Society's Annual Reports for 1909, his views are quite readily applicable to the case of the oxime of *cyclo*hexanone-4-carboxylic acid (III), described by Mills and Bain (*Trans.*, 1910, **97**, 1866), and regarding which they say (*loc. cit.*): "These substances may possess a certain interest in that they provide another example of compounds of which, like *d*- and *l*-inositol, and *d*- and *l*-1-methyl*cyclo*hexylidene-4-acetic acids

(Perkin, Pope, and Wallach, *loc. cit.*), the molecular asymmetry is more fittingly defined with reference to the configuration of the molecule as a whole than expressed in terms of the presence of some 'asymmetric atom.'"

The criticism contained in the author's previous paper (*loc. cit.*) was summed up in two alternative questions; Perkin and Pope have not satisfactorily answered either, but as justification for their claims they make three remarks, which, however, have no such effect.

Their first remark (*loc. cit.*) reads: "An asymmetric atom is never the cause of optical activity; optical activity is apparently invariable, and asymmetry of a carbon atom is, in special cases, the result of enantiomorphism of molecular configuration. Optical activity and the presence in the molecule of an asymmetric atom cannot be considered as mutually related in the sense of cause and effect." This statement compared with one made in their former paper on this subject, and which reads thus: "The optical activity is, in fact, not, as is still sometimes stated, due to the presence of an asymmetric carbon atom, but originates in the enantiomorphous molecular configuration." gives the whole of their position.

If, now, the contention of Perkin and Pope be proved correct, namely, that they, and Mills and Bain, have indeed produced compounds showing optical activity, *yet containing no asymmetric atom within their respective molecules*, then the author agrees that the above statements must be accepted; but, the author has shown—and in the present paper further supports his contentions—that both of the substances under discussion do contain an asymmetric carbon atom within their respective molecules. This being so, the author is of the opinion that the evidence bearing on this subject in literature is more likely to support his statement that it is a "generally accepted theory that the optical activity of a substance is due to the presence in it of an asymmetric atom," than to support the above statements of Perkin and Pope. On the other hand, the author would point out that such evidence as has thus far been gathered cannot be said to prove either of these statements.

In connexion with this, however, it is of interest to read a few lines which, if not written by Perkin, must at least have been assented to by him; thus on p. 544 of "Organic Chemistry," by Perkin and Kipping, we read: "That the property of rotating the plane of polarised light is *due* to the presence in the molecule of an asymmetric carbon atom is now practically proved by the fact that all optically active compounds of known constitution contain a carbon atom united in this way. . . ."

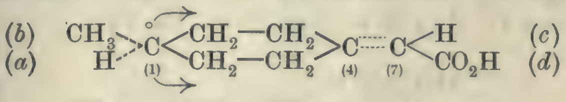
Now Perkin's change of view was quite natural when describing what was then thought to be the first case of an optically active substance in the molecule of which there was no asymmetric atom, but, now that the substance has been shown to contain an asymmetric carbon atom within its molecule, does not the work only strengthen the proof spoken of in the passage from Perkin and Kipping referred to above?

In their second statement [*loc. cit.*, (*b*) p. 1511] the first portion makes it quite clear that Perkin and Pope admit the author's contention that the configuration of the remainder of the molecule is different when taken either way, relative to the carbon atom (1), for they deny having made the assumption that it was not so. In the second portion they give what is, presumably, their reason for considering—despite their statement in the first portion of this remark—that carbon atom (1) is not asymmetric. The author shows elsewhere in this paper that such an argument cannot stand.

Their statement (*c*), by reason of partial quotation, is not a true representation of the author's views. His view is, that carbon atom (1) of 1-methyl*cyclo*hexylidene-4-acetic acid has each of its four valencies differently occupied, and is hence asymmetric. This view is quite clear in his former paper, and had Perkin and Pope even considered the whole of their original quotation from that paper, instead of only a small portion, they could not have failed to see this point.

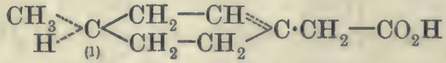
Now referring to the formula of 1-methyl*cyclo*hexylidene-4-acetic acid (I) [as previously, continuous lines represent bonds in the plane of the paper; broken lines bonds in a plane perpendicular to the first, and passing through carbon atoms (1), (4), and (7)]: in his

I.



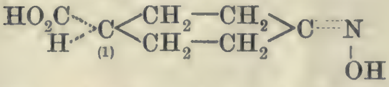
$$\begin{matrix}(b)\\(a)\end{matrix}\quad\begin{matrix}\mathrm{CH_3}\\\mathrm{H}\end{matrix}\!>\!\underset{(1)}{\mathrm{C}}\!<\!\begin{matrix}\mathrm{CH_2-CH_2}\\\mathrm{CH_2-CH_2}\end{matrix}\!>\!\underset{(4)}{\mathrm{C}}\cdots\underset{(7)}{\mathrm{C}}\!<\!\begin{matrix}\mathrm{H}\\\mathrm{CO_2H}\end{matrix}\quad\begin{matrix}(c)\\(d)\end{matrix}$$

II.



$$\begin{matrix}\mathrm{CH_3}\\\mathrm{H}\end{matrix}\!>\!\underset{(1)}{\mathrm{C}}\!<\!\begin{matrix}\mathrm{CH_2-CH}\\\mathrm{CH_2-CH_2}\end{matrix}\!>\!\mathrm{C\cdot CH_2-CO_2H}$$

III.



$$\begin{matrix}\mathrm{HO_2C}\\\mathrm{H}\end{matrix}\!>\!\underset{(1)}{\mathrm{C}}\!<\!\begin{matrix}\mathrm{CH_2-CH_2}\\\mathrm{CH_2-CH_2}\end{matrix}\!>\!\mathrm{C}\cdots\underset{\mathrm{OH}}{\mathrm{N}}$$

previous paper the author clearly pointed out that, in his opinion, carbon atom (1), whilst having two of its valencies attached to the hydrogen atom (*a*) and the methyl group (*b*) respectively, has the remaining two valencies (those forming part of the ring) attached to different systems, and hence, being attached to four quite dissimilar groups, is asymmetric.

This, it will be seen, very much resembles the manner in which Perkin and Pope (with Wallach) pointed out that carbon atom (1) in inositol was an asymmetric carbon atom (*loc. cit.*).

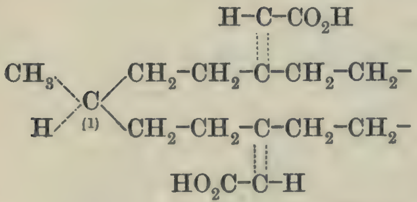
Now that Perkin and Pope [remark (*b*)] admit that the configuration of the 1-methyl*cyclo*hexylidene-4-acetic acid molecule, taken respectively in the direction of ↪ and in the direction of ⟶ relative to carbon atom (1), is not identical, it remains only to be shown that the difference is such that the carbon atom (1) is in the ordinary sense asymmetric.

Now to do so it is but necessary to compare the case of Marckwald and Meth's 1-methyl-Δ^3-*cyclo*hexene-4-acetic acid (II), regarding which Perkin and Pope (*loc. cit.*) say: "As the carbon atom numbered (1) in the latter constitutional formula is obviously attached to four constitutionally dissimilar groups, it is asymmetric in the ordinary sense;"

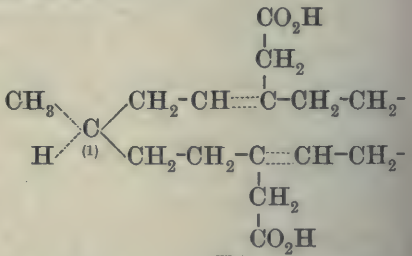
Now, in making comparisons, the rings only need be considered, for, taking carbon atom (1) in formulæ I and II, it is seen that in each case the two valencies which are outside the ring have attached to them a methyl group and a hydrogen atom. In formula III the methyl group is replaced by carboxyl.

Hence, if the difference shown between the two systems attached to carbon atom (1) and formed by the ring is in the case of 1-methyl*cyclo*hexylidene-4-acetic acid similar to that shown in the case of 1-methyl-Δ^3-*cyclo*hexene-4-acetic acid, then Perkin and Pope must surely admit that, on their own reasoning, the molecule of 1-methyl*cyclo*hexylidene-4-acetic acid contains an asymmetric carbon atom, the carbon atom (1).

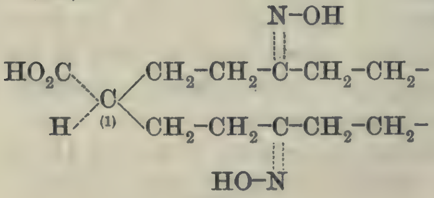
Now, treating the groupings as previously—and for that matter very much as done by Perkin, Pope, and Wallach for inositol—we get, on swinging open the ring of each molecule right and left, from I, IV; from II, V; and further, from III, VI:



(IV.)



(V.)



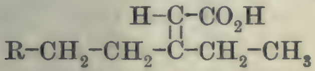
(VI.)

Now it is quite clear that in none of these cases, as they stand, are the two chain systems formed from the ring enantiomorphously related. In no way while remaining attached to the carbon atom (1) can they appear in the relation of object and mirror image; whilst, if they be detached from the carbon atom, they are *identical.* This is true of each of the three cases shown in IV, V, and VI respectively.

Hence it is seen that in reality, in each case, we are dealing with *one system*, but that that system is so constructed that the configuration relative to one end of the chain is different from that relative to the other end. The author therefore points out that, in his opinion, the differences thus shown in the systems attached to carbon atoms (1) in formulæ IV and VI must be considered to make those carbon atoms [(1) and (1)] asymmetric, if it is allowed that the differences shown by the two similar systems in formula V make carbon atom (1) of that formula asymmetric.

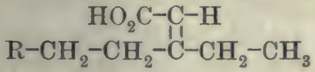
In support of this it may be pointed out that the compounds represented by α and α′ and by β and β′ would be expected to differ, α from α′ and β from β′, just as surely as γ would be expected to differ from γ′. (R not = H.)

α.



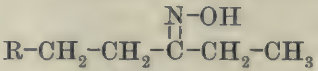
$$\mathrm{R{-}CH_2{-}CH_2{-}\overset{\substack{H-C-CO_2H\\ \|}}{C}{-}CH_2{-}CH_3}$$

α′.



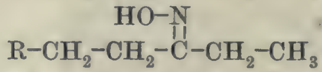
$$\mathrm{R{-}CH_2{-}CH_2{-}\overset{\substack{HO_2C-C-H\\ \|}}{C}{-}CH_2{-}CH_3}$$

β.



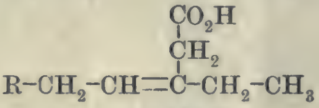
$$\mathrm{R{-}CH_2{-}CH_2{-}\overset{\substack{N-OH\\ \|}}{C}{-}CH_2{-}CH_3}$$

β′.



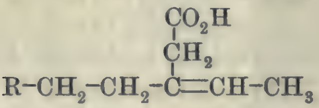
$$\mathrm{R{-}CH_2{-}CH_2{-}\overset{\substack{HO-N\\ \|}}{C}{-}CH_2{-}CH_3}$$

γ.



$$\mathrm{R{-}CH_2{-}CH{=}\overset{\substack{CO_2H\\ |\\ CH_2\\ |}}{C}{-}CH_2{-}CH_3}$$

γ′.



$$\mathrm{R{-}CH_2{-}CH_2{-}\overset{\substack{CO_2H\\ |\\ CH_2\\ |}}{C}{=}CH{-}CH_3}$$

Thus it is seen that the original conclusion of Perkin, Pope, and Wallach (*loc. cit.*) that in 1-methyl*cyclo*hexylidene-4-acetic acid they have realised "the first case of an optically active substance which possesses an enantiomorphous molecular configuration, although its constitutional formula contains no asymmetric atom," cannot be upheld, the methods used by them in removing Marckwald and Meth's acid and inositol from the field having been sufficient, when carefully applied, to trace the presence of an asymmetric carbon atom, both in the compound that they describe and also in that described by Mills and Bain. These compounds, therefore, are not centroasymmetric. Finally, it is necessary in this connexion to consider a statement made by Perkin and Pope in their recent paper (*loc. cit.*) regarding the 4-dibromo-1-methyl*cyclo*hexyl-4-acetic acids; it reads: "For purposes of classification, therefore, it is convenient to regard the dibromides as exhibiting two elements of asymmetry, namely, a centroasymmetry exhibited by the right-hand part of the configurations of Figs. 1, 2, and 3, and an asymmetry of the carbon atom (7), as is shown in Figs. 2 and 3."

There are many reasons why the classification suggested in this quotation should not be adopted, amongst them being the following:

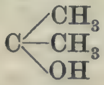
There is no centroasymmetry exhibited by the *right-hand* part of the configuration of Fig. 1, for if everything right of carbon atom (1) be included, the configuration is symmetric about the plane of the ring. That the asymmetry of the *whole* of the configuration is traceable to the asymmetry of carbon atom (1) has been discussed above.

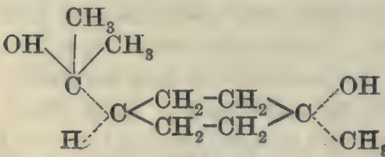
In Figs. 2 and 3 likewise, neither the *right-hand* nor the *whole* of the configurations show any asymmetry that is not traceable to carbon atom (7), and which is not destroyed when the asymmetry of that atom [carbon atom (7)] is destroyed.

Neither is it now possible to defend the system on the ground that it is but the counterpart of that by which many lævorotatory compounds are designated dextro, by reason of their having been derived from a dextro-parent substance—and vice versa—for the parent substance (1-methyl*cyclo*hexylidene-4-acetic acid) cannot now be looked upon as being "centroasymmetric."

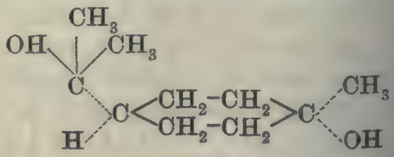
As mentioned above, in all these dibromo-compounds described by Perkin and Pope, and illustrated by them in Figs. 2 and 6 (*loc. cit.*), the asymmetry of the molecule is traceable to the carbon atom (7) and disappears with it.

In reality these bromo-derivatives are merely cases of *cis*- and *trans*-isomerism of cyclic compounds through the first instance of the isolation of the different optical isomerides derived therefrom.

Thus, *cis*-terpin (VII) and *trans*-terpin (VIII) are quite similar instances of this, and, moreover, although neither of these can be said to be centroasymmetric, yet by replacement of one of the methyl groups in the system  $C\begin{cases}CH_3\\CH_3\\OH\end{cases}$ by another group (not OH), then there are possible exactly similar isomerides as those discussed above—*d*- and *l*-*cis* and *d*- and *l*-*trans*—yet here, also, the asymmetry is entirely traceable to the asymmetric carbon atom thus produced.



(VII.)



(VIII.)

307. "Nitrites of the alkylammonium series. Part II. Propylammonium nitrite and butylammonium nitrite and their decomposition by heat." By Prafulla Chandra Rây and Jitendra Nath Rakshit.

Propylammonium nitrite decomposes when heated mainly into nitrogen, *iso*propyl alcohol, and water; small quantities of nitrosodipropylamine and in some cases nitric oxide and propylamine were also detected.

Butylammonium nitrite when heated decomposes into nitrogen and *iso*butyl alcohol.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Clowes, *Frank,* and **Coleman,** *Joseph Bernard.* Quantitative chemical analysis. 9th edition. pp. xxiv + 565. ill. London 1911. (*Recd.* 11/11/11.) From the Publishers: Messrs. J. & A. Churchill.

Friend, *John Albert Newton.* Elementary domestic chemistry. pp. x + 180. ill. London 1911. (*Recd.* 17/10/11.) From the Author.

Indian Guild of Science and Technology. Year Book 1911. pp. 135. ill. Letchworth 1911. (*Recd.* 11/11/11.) From the General Secretary

Local Government Board. Reports of Inspector of Foods. Nos. 1 to 16. London 1906–1911. (*Reference.*) From the Inspector of Foods.

Senter, *George.* Text-book of inorganic chemistry. pp. x + 583. ill. London 1911. (*Recd.* 4/11/11.) From the Author.

II. *By Purchase.*

Glikin, *W.* Kalorimetrische Methodik. Ein Leitfaden zur Bestimmung der Verbrennungswärme organischer Körper, einschliesslich Nahrungsstoffe und Stoffwechselprodukte und zur Messung der tierischen Wärmeproduktion. pp. vii + 208. ill. Berlin 1911. (*Recd.* 9/11/11.)

Worden, *Edward Chauncey.* Nitrocellulose industry. A compendium of the history, chemistry, manufacture, commercial application and analysis of nitrates, acetates and xanthates of cellulose. . . . With a chapter on guncotton, smokeless powder and explosive cellulose nitrates. 2 vols. pp. xxxiv + 566, xxviii + 567 to 1239. London 1911. (*Recd.* 14/11/11.)

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, December 4th, 1911.

All persons who received grants in December, 1910, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Friday, December 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

VAN'T HOFF MEMORIAL.

Subscriptions to this fund (see this vol., p. 272) will be received by the Treasurer of the Society (Dr. Alexander Scott).

At the next Ordinary Scientific Meeting on **Thursday**, December **7th**, 1911, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Chemical examination of the root of *Ipomosa orizabensis*." By F. B. Power and H. Rogerson.

"The constitution of ergothioneine, a betaine related to histidine." By G. Barger and A. J. Ewins.

"The methane equilibrium." By J. N. Pring and D. M. Fairlie.

"The absorption of the halogens by dry slaked lime." By W. A. R. Wilks.

"The decomposition of nitric acid by light." By W. C. Reynolds and W. H. Taylor.

"Note on the presence of iodic acid in commercial pure nitric acid." By W. C. Reynolds and W. H. Taylor.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

following Candidates have been proposed for election. A ballot will be held on December 7th, 1911.

Bescoby, Arthur Cecil,
Guestling, Hastings.

Science Master and Public Analyst. Camb. Nat. Sci. Tripos, 1908, 1st Class; Scholar and Prizeman, Emmanuel College: Inter-Collegiate Exam. 1907, 1st Class; Sci. Master, Hastings Grammar School, 1908–1911. Senior Sci. Master, Elizabeth College, Guernsey; States Analyst and Lecturer in Agricultural Chemistry to States of Guernsey; Author of "Elementary Course of Practical Chemistry," etc.

F. Gowland Hopkins.
J. Ll. Davies.
S. Allinson Woodhead.
W. R. R. Starling.
F. H. Neville.

Bull, Bertram Alfred,
Government Road, Nairobi, British East Africa.

Pharmaceutical Chemist. Silver Medallist, Chemistry, London College of Pharmacy, 1906; Minor and Major Examinations, Pharmaceutical Society; Pereira Medallist, Pharmaceutical Society, 1907.

F. G. P. Remfry.
H. A. D. Jowett.
H. C. Sayer.
W. C. Reynolds.
Frederic H. Lees.

Bull, Joseph Beauchamp,
Bulawayo.

Chemist and Assayer. Three years' course in Assaying and Chemistry at the Government School of Mines, Sale, Victoria, Australia. Four years in Chemists and Assayers Department Simmer and Jack Mine, Johannesburg. Ten years' practice with Mr. G. A. Pingstone, F.C.S., Member of Society of Public Analysts, Member of Royal Sanitary Institute.

Harold B. Dixon.
Charles Estcourt.
Geo. A. Pingstone.
James C. T. Pollitt.
C. G. Moor.

Charlton, Edwin Johnson, M.Sc.,

Morannedd, Beaumaris, North Wales.

Science and Second Master, The Grammar School, Beaumaris, North Wales. Teacher of Chemistry at the above Institution, M.Sc. (Chemistry) Manchester University. Desires to keep in touch with modern progress in the subject.

Harold B. Dixon.
W. H. Perkin.
Ch. Weizmann.
Norman Smith.
E. C. Edgar.
Arthur Lapworth.

Dutt, Prof. Barun Chandra, M.A.,

"Rambagan Cottage," Rambagan, Calcutta.

Professor, Scottish Churches College, Calcutta. Passed M.A Exam. in Chemistry (Calcutta University) in 1893. Formerly Professor of Chemistry in the Calcutta Central College and Metropolitan Institution. At present Professor of Chemistry in the Scottish Churches College, Calcutta.

Punchānan Neogi.
Jyoti Bhushan Bhaduri.
P. C. Rây.
Bidhu Bhushan Dutta.
John Watt.

Garner, John Henry,

Sewage Works, Deighton, Huddersfield.

Chemist in Charge, Sewage Disposal Works, Huddersfield. B.Sc., London, 3rd Class Honours in Chemistry, 1906. From March, 1907, to November, 1911, Chemical Assistant on the laboratory staff of the West Riding Rivers Board, Wakefield.

Arthur Smithells.
J. B. Cohen.
H. M. Dawson.
H. T. Calvert.
W. E. Speight.

Gauge, Arthur Josiah Hoffmeister,

2, Ashford Avenue, Hornsey, London, N.

Analyst, Government Laboratory, London, W.C. Student at Royal College of Science, S. Kensington, 1902–4; now at the Government Laboratory, Clement's Inn Passage, W.C.; author. See *Transactions*, Chemical Society, 1910, p. 377; 1911, pp. 683, 1075, 1615.

James J. Dobbie.
E. Grant Hooper.
Geo. Stubbs.
J. J. Fox.
P. J. Sageman.

Gaunt, Rufus,

70, Abingdon Villas, Kensington, W.

Senior Assistant, Scientific Department, Imperial Institute. M.Sc., Leeds; Ph.D., Berlin. Formerly Lecturer in Agricultural Chemistry, University College of North Wales.

Arthur Smithells. Thomas A. Henry.
J. B. Cohen. Ernest Goulding.
Sam. S. Pickles.

Hall, Sydney,

Birley House, Station Road, March, Cambs.

Senior Science Master and Lecturer in Chemistry at the Grammar School, March. Bachelor of Science of the Manchester University, taking Chemistry in the Final Exam. (1906). Twelve years' experience as a student and lecturer in Chemistry. Five years' experience as lecturer in Chemistry and Director of Chemical Laboratories.

Harold B. Dixon. Norman Smith.
W. H. Perkin. E. C. Edgar.
Ch. Weizmann. *Arthur Lapworth.*

Hodgson, Cyril Vincent,

80, Apedale Road, Chesterton, Staffs.

Analytical Chemist for Midland Coal, Coke, and Iron Co., Ltd. Certificates in Adv. Iron and Steel Manufacture and Chemistry Educated at the Middlesbrough High School. Five years' experience in Iron and Steel Works Laboratory, and Coke Works at Middlesbro', under Mr. C. H. Ridsdale; and for past two years Head Chemist for Midland Coal, Coke, and Iron Co., Staffs.

C. H. Ridsdale. W. M. Hooton.
J. E. Stead. *Ernest W. Jackson.*
R. B. Wight. *A. C. Wilson.*

Hodsman, Henry James,

2, Richmond Hill, Langley, nr. Birmingham.

Technical Chemist (British Cyanides Co., Ld., Oldbury). M.Sc. Leeds. 1851 Exhibition Science Scholar. Two years with Prof. F. Haber, Technische Hochschule, Karlsruhe; one year with Prof. H. Le Chatelier, La Sorbonne, Paris. Publications (with J. B. Cohen), "Influence of Substitution in the Nucleus on the Rate of Oxidation in the Side-chain" (*Trans.*, 1907, vol. 91, p. 970); (with F. Haber), "Die Zusammensetzung der Gase in sehr heissen Flammen" (*Zeit. Phys. Chem.*, 1909, vol. 67, 3, p. 343).

Arthur Smithells. Harry M. Dawson.
Julius B. Cohen. J. E. Coates.
Edmund C. Rossiter.

Hogg, Alexander Frederick,

81, Claremont Road, Forest Gate, E.

Principal of the West Ham Municipal Technical Institute. M.A.Cantab. (Natural Sciences Tripos); late Head of Chemical Department and Director of Studies at the Technical College, Darlington.

Raphael Meldola. George Dean.
F. H. Neville. J. Wertheimer.
F. Henry Streatfeild.

Khosla, Sant Ram,

Near City Kotwali, Lahore (India).

Student. Has been a Student in the Chemical Department of the Manchester School of Technology, Manchester, for four years. Recently obtained the Final Certificate in Chemical Technology of the Victoria University, Manchester. Had previously passed the Inter. Arts Exam. of the Punjab University, and other Exams.

Edmund Knecht. Stanley J. Peachey.
James Grant. F. S. Sinnatt.
Fred. G. Richards.

King, Harold, M.Sc.,

161, Altmore Avenue, East Ham, E.

Chemist with the Gas Light and Coke Co., Beckton, and holder of an Industrial Bursary (1851 Royal Commissioners). Joint-author of (I) "Purification of Acetic Acid," *Trans.*, 1911, 1178; (II) "A Method of Chlorination, Chlorination of Anilines and Phenols," *Trans.*, 1911, 1185; (III) "The Relation of the Velocity of Chlorination of Aromatic Compounds to Constitution. Part I. Chlorination of Anilides," *Trans.*, 1911, 1369; (IV) "The Chlorination of Acylanilides. Effect of the Constitution of the Acyl Group on the Proportion of the Ortho and Para Derivatives," *Trans.*, 1911, 1377.

Kennedy J. P. Orton. H. O. Jones.
Walter W. Reed. J. E. Coates.
W. J. Wilson.

Martin, Geoffrey,

4, Bertram Road, Hendon, London, N.W.

Science Teacher and Industrial Chemist. B.Sc. (Lond.), M.Sc. (Bristol); Ph.D. (Rostock); Recognised Teacher of London University; Lecturer on Chemistry at the Birkbeck College, London; formerly Lecturer and Demonstrator in Chemistry at the University College, Nottingham. Author of following books: (1) "Researches on the Affinities of the Elements"; (2) "Practical Chemistry for Matriculation and Army Candidates"; (3) "Triumphs and Wonders of Modern Chemistry." Joint-author with Prof. Kipping, F.R.S., of two papers in

Trans. Chem. Soc., namely, (1) "Action of Fuming Sulphuric Acid on Triphenylsilicol, [95, (1909)]"; (2) "Benzyl and Ethyl Derivatives of Silicol Tetrachloride (1909)"; Author of about fifty papers in *Journal of Physical Chemistry*, *Chemical News*, *Knowledge*, *Nature*, *Science*, *Gossip*, etc., etc.

F. Stanley Kipping. Frederick Challenger.
R. M. Caven. Alex. McKenzie.
Henry J. S. Sand. G. W. Clough.
Robert Robison.

Mills, Robert,

Plantation Uitolugt, W.C. Demerara, British Guiana.

Analytical Chemist. Two years Pharmaceutical work; six years Public Analysts' Laboratory, Greenock; five years Sugar Refinery work Greenock and Bristol, and nine and a half years Sugar Factory work India and Demerara.

John Wm. Biggart. Jno. Williams.
Angus Smith. William Douglas.
J. B. Harrison. *Alleyne Leechmann.*
John Young.

Nath, B. Viswa,

Vizianagaram City.

Chemist to the Rajah of Tuni, Tuni, Madras Presidency, India. Founder, Proprietor, and Manufacturing Chemist, Industrial Laboratory, Vizianagram; Assistant Chemist, Bobbili Mining Company; Chemist to the Rajah of Tuni, and is prepared to edit a Scientific Journal shortly.

P. C. Rây. M. Goolab Roy.
Lakshami Chand. *A. K. Sen.*
James W. Anderson.

Parkes, Thomas Peers,

22, Dalrymple Road, Brockley, S.E.

Manager of Chemistry Department, J. J. Griffin & Sons, Ltd., Kingsway, W.C. B.Sc. (London). Studied Chemistry at Goldsmiths' College, New Cross, S.E.

Arthur Lapworth. James D. Kettle.
C. Edwd. Sage. John Ward Stainer.
Frank E. Weston.

Peacock, David Henry,

40, Huddart St., Bow, London, E.

Research Student, Trinity College. First Class Nat. Sci. Tripos, 1910, (Pt. I), and 1911 (Pt. II, Chemistry). 2nd Class Honours, B.Sc., London, 1910 (External). Senior Scholar, Trinity College. Research Student in the University Laboratory.

William J. Pope.	H. J. H. Fenton.
W. J. Sell.	Charles T. Heycock.
H. O. Jones.	F. E. E. Lamplough.

Rao, B. Venkata,

Bangalore, Mysore, India.

Assistant Chemist, Government of Mysore. Graduate in Chemistry of the Madras University (1893). Assistant Chemist, Mysore Government, doing Analytical Work for the Geological and Agricultural Departments since 1895. From October, 1909, in Germany on Deputation to Study Agricultural Chemistry.

Harold Moore.	Frederick Challenger.
O. Wallach.	*W. N. Haworth.*
J. F. McGregory.	*A. Jamieson Walker.*

Raymond, Percy James,

20, Arboretum Road, Worcester.

Analytical Chemist. Food, Drug and General Analyst. Seven years Assistant to Mr. R. H. Harland, F.I.C., Public Analyst, 37, Lombard Street, London. Then: Assistant to Messrs. Harland and Brown (successors to Mr. R. H. Harland), Consulting Chemists and Public Analysts. Then and now: Assistant to Mr. C. C. Duncan, F.I.C., Shirehall, Worcester, County and City Analyst for Worcestershire.

Cecil Duncan.	H. J. Aubrey.
R. A. Warren.	*J. Stewart Rimington.*

Claude Smith.

Reilly, Joseph,

25, S. Circular Road, Portobello, Dublin.

B.A. (Hons.) National Univ. Ireland. Associate of Royal College of Science, Ireland (in Applied Chemistry). Holder of Scholarship (4th year) in Royal Coll. of Science. Associate of Royal Coll. of Science, Ireland (in Applied Chemistry). Honours Graduate National Univ. of Ireland (in Chemistry and Physics). Assistant Teacher at Depts. of Agriculture and Tech. Inst. (Ireland), Summer Course, 1911, (4th year Chemistry) for Secondary Teachers. Holder of Research Scholarship (in Chemistry), in R.C. Sc., Dublin, Session 1911–12.

A. O'Farrelly.	W. N. Hartley.
James H. Pollok.	George A. Watson.

P. Bertram Foy.

Ridsdale, Noël Douglas,

Ravenscroft, Roman Rd., Middlesbrough.

Analytical and Metallurgical Chemist. Several years since as

Student passed Senior, Cambridge; also gained certificates in Advanced Iron and Steel Manufacture and Chemistry. Seven years' experience in the North-Eastern Steel Co.'s Iron, Steel, and Coke Oven Laboratories, during which went through special course of Chemical and Metallurgical training under Mr. C. H. Ridsdale, F.I.C., F.C.S., etc. Special Research in connexion with analytical methods—designing new ones. Joint author of Paper before Iron and Steel Inst., on "Mechanicalising Analysis."

W. Gowland. J. E. Stead.
H. Frankland. W. H. Merrett.
Ernest W. Jackson. *Harold E. Wright.*
E. H. Saniter.

Saville, William Bristow,
117, Vassall Road, Brixton, S.W.

Analytical Chemist; 4½ years pupil to Mr. F. W. Richardson, F.I.C., etc., Analyst to the West Riding of Yorkshire. Assistant to Messrs. Harland and Brown, Analytical Chemists, Lombard Street, E.C., since May, 1910.

R. M. Harland. Wm. Keighley Walton.
F. W. Richardson. *A. B. Knaggs.*
A. Jaffé. *Saml. F. Stell.*
J. W. Pallister.

Scopes, Lionel Gowing,
3, Estcourt Street, Devizes, Wilts.

Analytical Chemist. Trained City and Guilds Tech. College, Finsbury. Author of "The Estimation of Tartaric Acid in the Presence of Malic and Succinic Acids," *Analyst*, August 1908; "The Uses of Trichlorethylene in Analytical Chemistry," *Analyst*, June 1910. Analyst to Wilts United Dairies, Devizes, Wilts. Late Assistant Research Lab. Mond Nickel Works, Swansea.

H. Droop Richmond. F. W. Harbord.
A. Chaston Chapman. F. Henry Streatfeild.
R. Meldola.

Smith, Bernard Charlie,
62, Filey Avenue, Upper Clapton, N.E.

Analytical Chemist. Apprentice for three years under Public Analyst. Chief Chemist at Welsbach Incandescent Mantle Co.

Roland J. May. Percy Edgerton.
W. M. Seaber. *Edwin M. Eagles.*
Thomas H. Pope.

Smith, John Henry,

10, Radnor St., Swindon, Wilts.

Analytical Chemist, G.W.R. Laboratory. The qualification is a large and varied experience in analytical work. The reason is that having secured appointment as Analytical Chemist to the Central Argentine Railway, I am very desirous of keeping in touch with advance in chemical science.

W. R. Bird. Thomas Hartley.
T. C. Davison. *J. H. B. Jenkins.*
L. Archbutt.

Stokes, George Alfred,

60, Parkhill Road, Hampstead, N.W.

Assistant to A. W. Stokes, F.I.C., F.C.S., Public Analyst. Student of City and Guilds Tech. College, Finsbury for four years, and obtained certificate. Student at Sir John Cass Tech. Institute. Student of Institute of Chemistry.

Alf. W. Stokes. H. Burrows.
R. Meldola. R. Bodmer.
Charles A. Keane. André Bracher.

Vakil, Kapibram H.

5, Santa Cruz, Bombay.

Chemist. Bachelor of Arts in Chemistry and Physics (Bombay University). Honours in Oils and Fats, City and Guilds of London. Bachelor of Technical Science (Victoria University).

Edmund Knecht. F. G. Richards.
Jas. Grant. S. J. Peachey.
F. S. Sinnatt.

Vanstone, Ernest,

Gwynfe House, Mount Pleasant, Neath, Glam.

Research Student. B.Sc. (Wales) with 1st Class Honours in Chemistry; 1851 Exhibition Research Scholar. Formerly "Isaac Roberts" Research Scholar, and Glamorgan Free Student, University College, Cardiff. Author of (1) "The Miscibility of Solids," *J.C.S.*, 1909; (2) "The Vapour Pressures of Solids and Solid Solutions," *J.C.S.*, 1910; (3) "A Physico-chemical Study of Mercury-Sodium Alloys," *Trans.*, Faraday Society, 1911.

William Ramsay. T. P. Hilditch.
R. Whytlaw-Gray. W. C. McC. Lewis.
N. T. M. Wilsmore.

Vipond, Harry James,

Department of Agriculture, Pretoria, South Africa.

Assistant Chemist, Agriculture Department, Union of South

Africa. B.A. and Diploma in Agriculture, University of Cambridge, six months as assistant in the laboratory of Dr. Bernard Dyer, in London, six months at the Rothamsted Experiment Station, two years in present position.

T. B. Wood.	A. Hutchinson.
Bernard Dyer.	H. O. Jones.

H. J. H. Fenton.

Wishart, George,

Royal School, Armagh.

Science Master. Late Science Scholar of Jesus College, Oxford, B.A. (Hons. in Final Chemistry Schools).

Harold Hartley.	D. L. Chapman.
N. V. Sidgwick.	H. B. Baker.

A. F. Walden.

Wright, Ernest Walter,

Connaught Club, Seymour Street, London, W.

Analytical Chemist. Chief Assistant to A. W. Stokes, Esq., F.I.C., Public Analyst. Student at the "Sir John Cass Technical Institute."

Alf. W. Stokes.	Charles A. Keane.
Cecil Revis.	H. Burrows.

André Bracher.

The following Certificates have been authorised by the Council for presentation to Ballot under Bye-law I (3):

Gardthausen, Charles Christian,

Pretoria.

Assistant Curator, Geological Survey, Transvaal. Assayer and Chemical Assistant to the Geological Survey, Transvaal, 1903 to date. Student under Mr. Castell Evans at the City and Guilds Institute, Finsbury, 1888–1889. Assayer to: the Jubilee G.M. Co., Van Ryn Estates G.M. Co., and George Goch G.M. Co., from 1889 to 1899.

A. Hutchinson.	*J. A. Wilkinson.*

Hill, James Hogan,

c/o Opium Agent, Ghazipur, U.P., India.

Opium Department. Student of the Royal College of Science, London, during the Session 1904–1905. Passed examinations in Inorganic and Organic Chemistry, and made a special study of the chemical analysis of opium under Professor Tilden.

E. R. Watson.	G. T. Morgan.
William Tate.	*G. O'B. Power.*

Nilié-Martin, Gaston,

South Coast Junction, Natal.

Chief Chemist to the South African Sugar Refineries, Ltd. Analytical Chemist on various sugar estates, chemical manure factories, assay laboratories, refineries, etc.

T. H. P. Heriot. James A. H. Armstrong.

Richardson, John Ffraid,

Government Quinine Factory, Mungpu, P.O., Sonada, Darjeeling
Himalayan Railway, India.

Assistant Quinologist to the Government of Bengal. Member of the Pharmaceutical Society. At present engaged in the manufacture of cinchona alkaloids, analysis of cinchona bark and its alkaloids, and research work on the same.

G. E. Shaw.

Vassiliev, Alexey Mïkhaïlovich,

Russia, Kasan, Chemical Laboratory of University.

Privat-docent at the University of Kasan; Assistant in the Chemical Laboratory of the Veterinary Institute; Secretary of the Technical Department of the Imperial Economical Society of Kasan. Member of Russian Physico-Chemical Society; of the Society of Naturalists of the University of Kasan; and of the Imperial Economical Society of Kasan. Author of 8 papers printed in the *Journal of the Russian Physico-Chemical Society*, and of 10 papers printed in the *Scientific Memoirs of the University of Kasan.*

F. M. Flavitzky. D. K. Dobrosserdov.
A. J. Bogorodsky. *Horace T. Brown.*

R. CLAY AND SONS, LTD., BRUNSWICK ST., STAMFORD ST., S.E., AND BUNGAY, SUFFOLK

[*Issued* 15/12/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 393.

Thursday, December 7th, 1911, at 8.30 p.m., Dr. M. Onslow Forster, D.Sc., Ph.D., F.R.S. (Vice-President), in the Chair.

Mr. F. Thomas was formally admitted a Fellow of the Society.

Certificates were read for the first time in favour of Messrs.:

Hilmar Johannes Backer, D.Chem., 4, Upper Bedford Place, W.C.
Ernest Arthur Bearder, M.Sc., Mayfield, Wythenshawe Road, Sale.
Gibbs Blackstock, B.A., 79, Prince Arthur Avenue, Toronto.
Frederic Fernandez Curtis, 20, Bury Street, Bloomsbury, W.C.
Rowland Holliday Ellis, Hope Cottage, Brayton Road, Selby.
Thomas Sidney Haines, 73, Kennington Avenue, Bristol.
William McMillan, 72, Wellington Street, Greenock.
Ernest Meyer Myers, c/o The Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent.
William Johnson Smith Naunton, B.A., B.Sc., 1, New Street, Woodbridge.
James Pettigrew Ogilvie, Homedale, Hendon Lane, Finchley, N.
William Raitt, Dehra Dun, N.P., India.
Walter Morrell Roberts, M.Sc., The Cedars, Whalley Range, Manchester.

Bertram James Smart, B.Sc., Testing Office, Lithgow, N.S.W.
Cecil Hamersley Waldron, 28, Hungerford Road, Camden Road, N.
John Charles Withers, Ph.D., 83, Edgeley Road, Clapham, S.W.

A ballot for the election of Fellows was held, and the following were declared subsequently duly elected:

Arthur Cecil Bescoby, B.A.
Bertram Alfred Bull.
Joseph Beauchamp Bull.
Edwin Johnson Charlton, M.Sc.
Barun Chandra Dutt, M.A.
Charles Christian Gardthausen.
John Henry Garner, B.Sc.
Arthur Josiah Hoffmeister Gauge.
Rufus Gaunt, M.Sc., Ph.D.
Sydney Hall, B.Sc.
James Hogan Hill.
Cyril Vincent Hodgson.
Henry James Hodsman, M.Sc.
Alexander Frederick Hogg, M.A.
Sant Ram Khosla.
Harold King, M.Sc.
Geoffrey Martin, M.Sc., Ph.D.
Robert Mills.
Bhâgavatula Viswa Nath.
Gaston Nilié-Martin.
Thomas Peers Parkes, B.Sc.
David Henry Peacock, B.A., B.Sc.
B. Venkata Rao, B.A.
Percy James Raymond.
Joseph Reilly, B.A.
John Ffraid Richardson.
Noël Douglas Ridsdale.
William Bristow Saville.
Lionel Gowing-Scopes.
Bernard Charlie Smith.
John Henry Smith.
George Alfred Stokes.
Kapibram Hardevram Vakil, B.A.
Ernest Vanstone, B.Sc.
Alexey Mikhaïlovich Vassiliev.
Harry James Vipond, B.A.
George Wishard, B.A.
Ernest Walter Wright.

Of the following papers, those marked * were read:

*308. "Chemical examination of the root of Ipomoea orizabensis." By Frederick Belding Power and Harold Rogerson.

The material employed for this investigation consisted of the root of *Ipomoea orizabensis*, Ledanois (Nat. Ord. *Convolvulaceae*), commonly known as "Mexican Scammony Root."

The root contained 14·55 per cent. of resin, 71 per cent. of which was soluble in ether. After purification with animal charcoal, the resin was obtained nearly colourless. It then melted at 125—130°, and had $[\alpha]_D - 23\cdot0^\circ$.

For a complete examination of the root, 48·76 kilograms of the ground material were extracted with hot alcohol. The resulting extract, when distilled in a current of steam, yielded a small amount of a pale yellow essential oil.

From the portion of the extract which was soluble in water the following compounds were isolated: (i) scopoletin, $C_{10}H_8O_4$; (ii) 3:4-dihydroxycinnamic acid, $C_9H_8O_4$, from which the *methyl* ester (m. p. 158—160°) was prepared. The aqueous liquid contained, furthermore, a quantity of sugar, which yielded *d*-phenylglucosazone (m. p. 205—206°), and from a portion of the original alcoholic extract a small amount of sucrose was also obtained.

The portion of the alcoholic extract which was insoluble in water consisted of a resin which possessed the above-mentioned characters. This resin, by successive extraction with various solvents, was resolved into a number of products which were for the most part amorphous, and not entirely glucosidic, but by the further treatment of these products many well-defined substances were obtained. It has thus been shown that the resin is exceedingly complex in character, and it follows that the so-called "jalapin," which includes all those constituents of the resin which are soluble in ether, cannot be represented by any of the various formulæ hitherto assigned to it.

*309. "The constitution of ergothioneine: a betaine related to histidine." By George Barger and Arthur James Ewins.

Ergothioneine, $C_9H_{15}O_2N_3S$, a crystalline base isolated from ergot by Tanret in 1909, has been found to be a betaine of thiolhistidine (α-amino-β-2-thiolglyoxaline-4(or 5)-propionic acid).

On boiling with 50 per cent. aqueous potassium hydroxide trimethylamine is eliminated, and an acid, $C_6H_6O_2N_3S$ (β-2-thiolglyoxaline-4(or 5)-acylic acid), is obtained. On oxidation with dilute nitric acid the latter yields β-glyoxaline-4(or 5)-acrylic acid, from which on reduction β-glyoxaline-4(or 5)-propionic acid is produced.

The treatment of ergothioneine with ferric chloride leads to the formation of histidine-betaine.

*310. "The methane equilibrium."

By John Norman Pring and Dorian Macefield Fairlie.

Carbon was heated electrically in hydrogen at definite known temperatures between 1100° and 2000°, and under pressures between 10 and 200 atmospheres. The velocity of the formation of methane was found to increase rapidly with the pressure, and to proceed to a final equilibrium stage.

As would follow from the law of mass action for a true equilibrium, the value of $p\text{-}CH_4/p\text{-}(H_2)^2$ was always found to be constant under different pressures if the temperature were the same, and the same modification of carbon used.

With amorphous carbon, temporary equilibrium values were obtained, in which at all temperatures the amount of methane was greater than that corresponding with the true equilibrium with graphite. The relative difference between the equilibrium values for amorphous carbon and graphite increases with the temperature. It follows from this, by applying Kirchhoff's law, that the mean specific heat of amorphous carbon is, at all the temperatures concerned in this work, higher than that of graphite, and that the difference increases with the temperature.

No appreciable effect was exerted by high pressures on the yield of acetylene and ethylene, and no other hydrocarbon was formed.

*311. "The decomposition of nitric acid by light."

By William Colebrook Reynolds and William Henry Taylor.

The authors have investigated the decomposition of nitric acid by light, and find that the reaction is reversible, the products of decomposition slowly recombining more or less completely in the absence of light. The extent of the decomposition and recombination was illustrated by a series of curves. They have proved that pure anhydrous nitric acid decomposes very slowly in the dark, giving the same products of decomposition.

DISCUSSION.

Dr. VELEY expressed his satisfaction that the authors had amply confirmed the conclusion drawn from certain elementary experiments by Manley and himself (*Phil. Trans.*, 1908, *A*, **191**, 367) that the vapour of nitric acid rather than the liquid is decomposed by sunlight. The observations of the authors that the reaction, $4HNO_3 = 2H_2O + 2N_2O_4 + O_2$, is reversible on alteration of conditions, appeared to be of especial interest, and was in accordance with results obtained in the study of other reactions in which nitric acid took part.

More information might possibly have been obtained from the authors' results if sunshine records had been given; although it was shown that the actinic effect of the sun was greater in August than in May, a result to be expected, yet the difference found between the effects in May and March was almost inappreciable, a result contrary to general experience.

Professor T. TURNER asked for information as to the method whereby the pressure in the tubes had been estimated, and how the gases were collected and measured. It was also suggested that by means of a capillary tube closed at the upper end and inserted inside the closed tube, a continuous series of pressure observations might perhaps be taken, instead of only determining the final pressure at the end of the test.

Dr. Scott asked whether the authors had considered the possibility of traces, especially of hydrochloric acid and of iron, acting as catalysts. These and other substances which might act thus might conceivably come from the glass apparatus used.

The curves of the pressures obtained with the various proportions of liquid and vapour space were remarkable in the case of a reversible action.

Mr. Reynolds, in reply to Dr. Scott, stated that it was possible that traces of iron and chlorine too small to be detected by the ordinary reagents were present in the acid employed through contact with glass. If such traces affected the results, it was, however, curious that the phenomena were so regular when different samples were employed, and that in clear silica tubes rather greater decomposition occurred than in glass; moreover, as only the vapour was decomposed, it was unlikely that iron affected the phenomena.

*312. "Derivatives of *o*-xylene. Part I. 3-Nitro-*o*-xylene and 3:6-dinitro-*o*-xylene." By Arthur William Crossley and Gertrude Holland Wren.

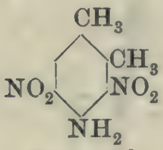
3-Nitro-*o*-xylene has been prepared from 3:4-dinitro-*o*-xylene by reduction with stannous chloride to 3-nitro-*o*-4-xylidine, and replacement of the amino-group in this substance by a hydrogen atom. A comparison of the properties of 3-nitro-*o*-xylene obtained in this way with the 3-nitro-*o*-xylene isolated from the products of the action of a mixture of nitric and sulphuric acids on *o*-xylene (*Trans.*, 1909, **95**, 208) shows that the latter contains some of the isomeric 4-nitro-*o*-xylene, probably about 7 per cent.

3:6-Dinitro-*o*-xylene (compare *Trans.*, 1909, **95**, 210) has now been obtained in a pure condition from the products of direct nitration of *o*-xylene. It crystallises from alcohol in sheaves of needles, melting at 89—90°.

*313. "Derivatives of *o*-xylene. Part II. Dinitro-*o*-xylidines." By Arthur William Crossley and George Francis Morrell.

Attempts to prepare 3:6-dinitro-*o*-xylene by conversion of 3:4:6-trinitro-*o*-xylene into 3:6-dinitro-*o*-4-xylidine and elimination of the amino-group from this substance have been unsuccessful. The nitro-group in position 3 is the one attacked by reducing agents.

In the course of the experiments five of the six theoretically possible dinitro-*o*-xylidines have been prepared, and their properties



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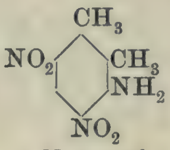
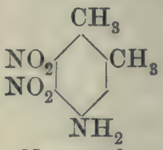
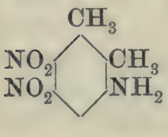


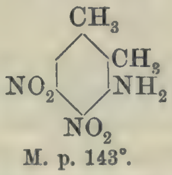
M. p. 161°.



M. p. 210°.



M. p. 172°.



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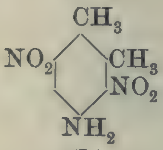


(I.)

were described. The missing 3:6-dinitro-*o*-4-xylidine (I) is the one which it was desired to prepare for the initial object of this research.

DISCUSSION.

Dr. MORGAN drew attention to the interesting analogy existing between the interaction of alcoholic ammonia and 3:4:5-trinitro-*o*-xylene and 3:4:6-trinitro-*o*-xylene, whereby the mobile nitro-groups (4-NO_2 and 3-NO_2 respectively) were replaced by amino-groups, and the formation of aromatic amines from 1-chloro-2:4-dinitrobenzene or 1:2:4-trinitrobenzene, in which a mobile chloro- or nitro-radicle is directly replaced by an amino-group. This extreme mobility of the chloro- or nitro-radicle was conditioned by the presence of two other nitro-groups in ortho-para- or di-ortho-positions with respect to the reactive substituent (compare Hepp, *Annalen*, 1882, **215**, 363).

314. "The absorption of the halogens by dry slaked lime."

By William Arthur Reginald Wilks.

It was shown that bromine is absorbed from carbon tetrachloride solution by slaked lime (dried in a vacuum), with the production of an "adsorption compound," which is brick-red. The colour of "bromine bleaching powder" is due to this product. Iodine gives a similar adsorption compound, which is almost black.

The concentrations of bromine in the solution (C_2) and in the lime (C_1) are connected by the formula $\frac{C_1}{C_2^n} = k$, when n is one-third. The adsorption of iodine obeys a similar formula, n being still one-third, but the constant k has a value different from that of bromine.

Adsorption phenomena could not be detected when chlorine was absorbed by dry slaked lime under the same conditions as before, but the results showed that in this case a chemical compound was formed.

315. "A method of determining carbon and nitrogen in organic compounds." By Edward Percy Frankland.

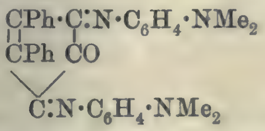
With reference to the author's method for the simultaneous determination of carbon and nitrogen in organic substances (*Trans.*, 1911, **99**, 1783), his attention has been drawn to the fact that similar determinations were made by Klingemann (*Annalen*, 1893, **275**, 92), using a gas apparatus for the estimation of nitrogen and carbon dioxide. Whilst aware that Dr. Klingemann had carried out an investigation on the production of nitric oxide during the combustion of nitrogenous substances in a vacuum (*Ber.*, 1889, **22**, 3064), the author regrets that he was not previously cognisant of the fact that determinations of carbon in organic compounds had been made by the Frankland-Armstrong process, and that, therefore, he was unable to make reference to Dr. Klingemann's second communication on this subject.

The author considers that the principal advantage of the process as described by him lies in the avoidance of all complicated apparatus for gas analysis, thus rendering the method of more general utility.

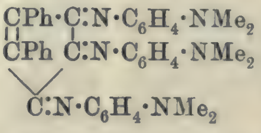
316. "Diphenyl*cyclo*pentenone."

By Siegfried Ruhemann and William Johnson S. Naunton.

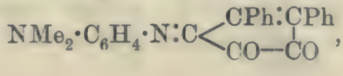
With the view of preparing cyclic triketones with three adjacent ketonic groups similar to triketohydrindene, 3:4-diphenyl*cyclo*pentenone (Japp and Lander, *Trans.*, 1897, **71**, 131) was treated with *p*-nitrosodimethylaniline. This reaction yields two condensation products with two and three dimethylaminoanilo-groups respectively:



and

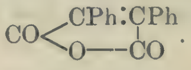


Both compounds on hydrolysis with mineral acids yield 5-*dimethylaminoanilo*-3:4-*diphenyl*cyclo*pentene*-1:2-*dione*:



$$NMe_2\cdot C_6H_4\cdot N{:}C{<}\begin{matrix}CPh{:}CPh\\ CO{-}CO\end{matrix},$$

which on heating with concentrated hydrochloric acid at 130—140° forms diphenylmaleic anhydride:



5-Dimethylaminoanilo-3:4-diphenyl*cyclo*pentene-1:2-dione when treated with bromine gives a yellow *bromo*-derivative,

$C_{25}H_{19}O_2N_2Br$,

but with an excess of the halogen an unstable *perbromide* is produced, which on boiling with alcohol decomposes to yield the same yellow monobromo-derivative along with a scarlet *dibromo*-compound, $C_{25}H_{18}O_2N_2Br_2$.

With fuming nitric acid the substance forms a scarlet *dinitro*-derivative, $C_{25}H_{18}O_2N_2(NO_2)_2$; on reduction with zinc dust and acetic acid it furnishes a colourless compound, $C_{25}H_{22}O_2N_2$.

5-Dimethylaminoanilo-3:4-diphenyl*cyclo*pentene-1:2-dione is deep red or orange, according to whether it separates from concentrated or dilute alcoholic solutions. It forms salts, which, however, readily dissociate with water. It, further, has the remarkable property of being transformed into a colloid on the addition of water to its solutions in absolute alcohol or acetone. This spontaneously liquefies, with separation of crystals in the course of two or three days. Neither the bromo- nor the nitro-derivatives show this phenomenon.

317. "Electrolytic reduction. Part V. Benzylidene bases."

By Herbert Drake Law.

A series of compounds were reduced by the electrolytic method in continuation of similar experiments with the aromatic aldehydes. The results agreed closely with those previously obtained. Two classes of compounds were formed, according to the following general equations:

$$R\cdot CH{:}X + 2H = R\cdot CH_2\cdot XH.$$
$$2R\cdot CH{:}X + 2H = R\cdot CH(XH)\cdot CH(XH)\cdot R.$$

Thus benzylidene-*p*-toluidine yielded benzyl-*p*-toluidine, di-*p*-toluidinodibenzyl, and a green resin. The relative quantity of each constituent varied with the conditions of the experiment, but followed the same rules as those previously given in the case of benzaldehyde. The quantities of each substance formed varied very considerably with a change in constitution. The resin formed diminished as the formula of the reduced substance approached the most symmetrical arrangement of the substituted groups.

318. "The porosity of iron and its relation to passivity and corrosion." By John Albert Newton Friend.

The author showed that: (1) The surface of iron is slightly porous, so that when the metal is immersed in certain solutions the latter are absorbed to a minute extent. (2) The passivity induced by immersion of iron in alkaline solutions, such as those of sodium and potassium hydroxides, is due to absorption of small quantities of these alkalis within the pores of the metal. (3) There are thus more kinds of passivity than one.

319. "Molecular rotatory power in normal homologous series. Part I. Optically active derivatives of the higher aliphatic alcohols and acids." By Thomas Percy Hilditch.

The variation of different types of physical properties in consecutive members of an homologous series was discussed, and it was pointed out that whilst the more additive properties increase in arithmetical progression on ascending such a series, certain essentially constitutive properties tend in these circumstances to arrive at a constant value.

A survey of the existing data on the molecular rotatory powers of optically active homologues shows that here also, although hitherto only the first few members of series of this type have been available, this function nevertheless reaches in many cases an approximately constant figure, characteristic of the optically active series concerned; moreover, those series which do not yield constant values for $[M]_D$ almost invariably contain strongly unsaturated groups.

The author therefore proposes to investigate the homologues of higher molecular weight of some apparently irregular series, in order to determine whether the presence of unsaturation is here a disturbing factor in the lower members. To this end it was necessary in the first place to ensure that, in series the lower members of which rapidly attained constancy of molecular rotatory power, the homologues of high molecular weight should maintain their "series constant" of molecular rotation.

Investigation of the *l*-menthyl esters, and brucine and cinchonine salts of myristic, palmitic, and stearic acids, and of the hydrogen camphorates and camphor-β-sulphonates of cetyl and myricyl alcohols, showed that, within narrow limits, the molecular rotatory powers of the normal aliphatic esters of *l*-menthol, *d*-camphoric acid, and *d*-camphor-β-sulphonic acid, and of the normal aliphatic salts of brucine and cinchonine become numerically constant in each series after the first few members are passed.

320. "Molecular rotatory power in normal homologous series. Part II. The menthyl esters of the α-bromoaliphatic acids." By Harold Christopher and Thomas Percy Hilditch.

The effect of introducing an unsaturated group in close proximity to the carboxyl residue of a series of optically active normal aliphatic esters has been studied by the authors in connexion with the problem of the disturbing effect of unsaturation referred to in the preceding paper.

The α-bromo-derivatives of the aliphatic esters of *l*-menthol were employed in the present investigation on account of the ease with which these compounds may be obtained in the pure condition.

It was found that whilst the first two members of the series (menthyl bromoacetate and α-bromopropionate) possessed molecular rotatory powers markedly above the normal, the anomaly rapidly declined to a minimum, slightly sub-normal value, thereafter rising very much more gradually to an approximately constant value (in the case of menthyl α-bromomyristate and α-bromopalmitate). The final constant molecular rotations appeared to be a very few degrees in excess of those of the corresponding members of the saturated, non-substituted aliphatic menthyl esters.

321. "Note on methyl-*n*-tridecyl- and methyl-*n*-pentadecyl-carbinols and the corresponding ketones." By Robert Howson Pickard and Joseph Kenyon.

In a recent communication (*Trans.*, 1911, **99**, 45) the authors have described the resolution into their optically active components of the members of the series of carbinols from methylethylcarbinol to methyl-*n*-undecylcarbinol. It was intended to continue the series so as to include methyl-*n*-tridecyl- and methyl-*n*-pentadecyl-carbinols, but it has been found that the method of bringing about the resolution of the various members of the series fails in the case of these carbinols, containing fifteen and seventeen carbon atoms respectively. This note contains a short description of the compounds isolated during the course of the experiments, and also shows that the catalytic method with thorium oxide (Senderens, *Compt. rend.*, 1909, **149**, 995) can be used for the formation of ketones, even when they contain many carbon atoms.

Methyl-n-*tridecyl Ketone*, $CH_3 \cdot CO \cdot C_{13}H_{27}$.—Myristic acid (300 grams) dissolved in glacial acetic acid (2400 grams) was passed at an hourly rate of 50 c.c. through a Jena-glass tube containing thorium oxide, and heated to 400°. The products of the reaction were condensed, dissolved in ether, and washed with a solution of sodium hydroxide until free from acid. Myristic acid (125 grams) was recovered from the washings, mixed afresh with glacial acetic acid, and again treated. When the products from the two operations were fractionally distilled, 200 grams of methyl-*n*-tridecyl ketone were obtained. The residue in the flask when recrystallised from ethyl alcohol yielded 30 grams of myristone, which melted at 75—76°.

*Methyl-*n*-tridecyl ketone* boils at 184°/20 mm., and on cooling sets to a soft mass of crystals, which melt at 37°. It readily forms the *semicarbazone*, which crystallises from ethyl alcohol in needles melting at 126·5°. (Found, N = 15·0. Calc., N = 14·8 per cent.)

*Methyl-*n*-tridecylcarbinol*, $CH_3 \cdot CH(OH) \cdot C_{13}H_{27}$, is readily obtained when the corresponding ketone is reduced by sodium in 96 per cent. alcoholic solution, little, if any, pinacone being formed. It boils at 181—183°/19 mm., and on cooling sets to a crystalline mass, which melts at 38—39°.

The *hydrogen phthalate** crystallises from light petroleum in pearly leaflets, and melts at 61—62°. The *brucine* salt crystallises from acetone in needles, which, when dried in the air, melt at 80—85°, but after desiccation in a vacuum or after heating at 105° for a few minutes they melt at 172—175°. After two recrystallisations, on polarimetric examination:

1·0136, made up to 20 c.c. with ethyl alcohol, gave $\alpha - 6{\cdot}25°$, whence $[\alpha] - 61{\cdot}66°$.

The *strychnine* salt crystallises from chloroform and acetone in hair-like needles, melts about 130°, and has $[\alpha]_D - 52{\cdot}6°$ when dissolved in chloroform. The hydrogen phthalate obtained from the purest specimen of these salts was in each case found to be quite inactive when examined in the polarimeter.

The *hydrogen succinate* crystallises from light petroleum in nacreous leaflets, which melt at 60—61°. The *brucine* salt is a wax, and unsuitable for fractional crystallisation.

The corresponding derivatives of heptadecane were obtained by similar methods.

Seventy-nine grams of *methyl-*n*-pentadecyl ketone*,

$$CH_3 \cdot CO \cdot C_{15}H_{31},$$

were obtained from 112 grams of palmitic acid. It boils at 197°/12 mm., crystallises from ethyl alcohol in pearly leaflets melting at 48°, and can be regenerated unchanged from the *semicarbazone*, which crystallises from dilute ethyl alcohol in very small needles melting at 125·5°.

*Methyl-*n*-pentadecylcarbinol* boils at 230°/16 mm., forms indefinitely shaped crystals, and melts at 46°. The *hydrogen phthalate* separates from light petroleum as a mass of needles, which melt at 50—51°. The *hydrogen succinate* separates from light petroleum in a microcrystalline condition, and melts at 64—65°. The *brucine* salts of each of the esters were prepared and recrystallised several times, but no ester could be obtained which exhibited any trace of optical activity.

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* The purity of each of the acid esters described in this note was ascertained by titration of their alcoholic solutions with a standard solution of sodium hydroxide.

322. "An experimental investigation of the bleaching process." By Sydney Herbert Higgins.

Solutions of the hypochlorites of lithium, sodium, and potassium prepared from bleaching powder solution by precipitation with solutions of the alkali sulphates or carbonates have identical bleaching properties; the bleaching efficiencies of these solutions are almost equal to that of the original bleaching powder solution. Curves showing (1) the evolution of oxygen from hypochlorite solutions and from solutions of sodium peroxide in contact with copper oxide; (2) the rate of bleaching of solutions of hypochlorites and of sodium peroxide; (3) the rate of oxidation of oxalic acid by potassium permanganate and the rate of liberation of iodine from potassium iodide by acidified sodium peroxide solution (Harcourt and Esson, *Phil. Trans.*, 1866, **156**, 193), point to the conclusion that the actions in all these cases are similar, that is, unimolecular. Hypochlorites therefore bleach because of their readiness directly to produce nascent oxygen. Those substances which accelerate the evolution of oxygen from solutions of hypochlorites or of peroxides also assist the evolution of that gas when they are heated along with potassium chlorate; hence it is taken that the main action in the latter case is a unimolecular one. Chlorine water is a much weaker bleaching agent than solutions of hypochlorites; therefore the bleaching action of the latter cannot be due to the generation of free chlorine as stated by Taylor (*Trans.*, 1910, **97**, 2541). Chlorine water probably owes its bleaching properties to the presence of hypochlorous acid in solution. The proof that the production of chlorine from bleaching powder solution and the stimulation of the bleaching action of that solution have no connexion with one another has led the author to consider the two questions separately. In pursuit of this line of argument he gave further experiments supporting previous conclusions (compare Taylor, this vol., p. 243).

323. "The direct esterification of saturated and unsaturated acids." By Ebenezer Rees Thomas and John Joseph Sudborough.

The esterification of a number of saturated and unsaturated organic acids has been studied by heating the acid with a large excess of pure ethyl alcohol at 100° in sealed tubes for given periods, and titrating the amount of free acid left.

The results show that an $\alpha\beta$-olefine linking has a retarding effect, except when the unsaturated acid is a very much stronger acid than its saturated analogue, for example, methyl hydrogen maleate, which is some two hundred times as strong an acid as methyl hydrogen succinate. In such a case the olefinic acid is esterified more rapidly than the corresponding saturated acid.

A $\beta\gamma$-unsaturated acid is usually esterified somewhat more rapidly than its saturated analogue, and a $\gamma\delta$-olefinic linking appears to have but little effect on the rate of esterification.

The influence of substituents in both saturated and unsaturated acids is marked.

324. "The influence of three- and four-membered carbon rings on the refractive and dispersive power of organic compounds." By Gustaf Jim Östling.

The molecular refraction and dispersion of several derivatives of *cyclo*propane and *cyclo*butane have been determined and calculated according to the formula:

$$MR = \frac{n^2 - 1}{n^2 + 2} \times \frac{M}{L}.$$

The *cyclo*propane derivatives were tanacetone and its derivatives, esters of carbonic acids, a new hydrocarbon, namely, 1:2-*dimethyl*cyclo*propane*, and some others. The *cyclo*butane compounds were chiefly esters of various acids.

It was shown that (1) the three- as well as the four-carbon ring exerts an influence on the molecular refraction. The increment in the case of a three-carbon ring is for M_α +0·67 and for M_D +0·71; in the case of a four-carbon ring for M_α +0·45 and for M_D +0·48. (2) A small exaltation is noticeable when the three-carbon ring is conjugated with a double bond ($E\Sigma_D = +0{\cdot}2$). (3) The three- and the four-carbon rings have practically no influence on the molecular dispersion. (4) The conjugation of a three-carbon ring and a double bond increases the molecular dispersion about 10 per cent.

The magnetic rotation for a saturated tricyclic terpene, β-pinolene, has also been determined.

325. "Contributions to our knowledge of semicarbazones." (Preliminary note.) By Isidor Morris Heilbron and Forsyth James Wilson.

In the course of some recent experiments the authors observed that *m*-nitrobenzylidenedeoxybenzoin on treatment with semicarbazide acetate formed two distinct semicarbazones, a colourless and a yellow modification. The addition of sodium hydroxide solution to an alcoholic solution of either the colourless or the yellow form produced an intense yellow coloration, which was destroyed by acids.

As semicarbazones have not as yet been very fully studied, the authors are extending their observations to semicarbazones derived from both saturated and unsaturated ketones and aldehydes.

Phenyl styryl ketone gives on direct treatment with semicarbazide acetate two distinct semicarbazones: a colourless form, melting at 168°, which is rapidly precipitated from a dilute alcoholic solution, and a more soluble yellow form obtained by dilution of the mother-liquors. On attempting to recrystallise this yellow modification from chloroform, the authors found that it passes into a third modification, which crystallises in colourless, silky needles melting at 180°. This semicarbazone in the dry state is unstable, being gradually reconverted on exposure to diffused sunlight into the yellow modification. No melting point for this yellow form can be obtained, as it passes when heated above 160° into the colourless modification melting at 180°. Alcoholic solutions of both colourless semicarbazones give with sodium hydroxide intensely yellow products, which are still under investigation.

The absorption spectra of these various semicarbazones are being investigated in the hope of throwing further light on the subject.

It has also been found that semicarbazones of both saturated and unsaturated aldehydes and ketones are affected by ultraviolet light, stereoisomerides being apparently produced in some cases, decomposition products in others. Investigations in this direction are also in progress.

326. "Conductivity and dissociation of diacetyltartaric acid."

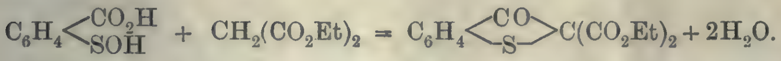
By Stella Deakin and Albert Cherbury David Rivett.

Diacetyltartaric anhydride is hydrated too rapidly for the course of the action to be followed by the conductivity method (compare Rivett and Sidgwick, *Trans.*, 1910, **93**, 732, 1677). Since some connexion appears to exist in such a case between rate of hydration and first dissociation constant of the acid, a determination of the latter was desirable, and has been made, giving the value $2\cdot5 \times 10^{-2}$, a higher figure than is given by the acid corresponding with any anhydride the rate of hydration of which has been measured. The second dissociation constant approximates to $0\cdot11 \times 10^{-2}$.

327. "A synthesis of 'thioindigo.'" (Preliminary note.)

By William George Prescott and Samuel Smiles

When *o*-thiol- or *o*-dithio-benzoic acid is treated with malonic acid or its ester in the presence of warm concentrated sulphuric acid a vigorous reaction occurs, and "thioindigo" is formed. From preliminary experiments the yield of the latter substance appears to be as high as about 85 per cent. of the theoretical, exclusive of thioindigosulphonic acid which is simultaneously produced. Traces of hydroxybenzothiophen were also isolated. There is no doubt that the preliminary stage of the interaction depends on the formation of the sulphoxylic acid (*Trans.*, 1911, **99**, 640), which then reacts as follows:



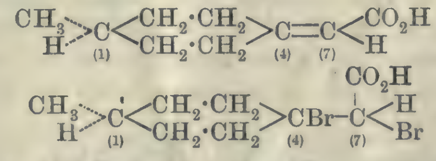
$$C_6H_4{<}\begin{matrix}CO_2H\\SOH\end{matrix} + CH_2(CO_2Et)_2 = C_6H_4{<}\begin{matrix}CO\\S\end{matrix}{>}C(CO_2Et)_2 + 2H_2O.$$

Condensation of these thio-acids with ethyl acetoacetate, substituted malonic acids, and similar substances may also be effected; these interactions are now being more closely investigated.

328. "Asymmetry in the supposed absence of an asymmetric atom."

By James Ernest Marsh.

Everest's paper (this vol., p. 285) disposes effectively of the claim that a new type of asymmetry exists which is not dependent on the presence of an asymmetric atom in the molecule. At the same time the views of Everest involve him in a difficulty of another kind: in the conversion of the unsaturated acid into its dibromide, the asymmetric carbon atom (1) is represented as losing its asymmetry, while a new asymmetric carbon atom (7) is created in a different part of the molecule outside the ring:



$$\begin{matrix}CH_3\\H\end{matrix}{>}\underset{(1)}{C}{<}\begin{matrix}CH_2\cdot CH_2\\CH_2\cdot CH_2\end{matrix}{>}\underset{(4)}{C}{=}\underset{(7)}{C}{<}\begin{matrix}CO_2H\\H\end{matrix}$$

$$\begin{matrix}CH_3\\H\end{matrix}{>}\underset{(1)}{C}{<}\begin{matrix}CH_2\cdot CH_2\\CH_2\cdot CH_2\end{matrix}{>}\underset{(4)}{CBr}-\underset{(7)}{\overset{\overset{CO_2H}{|}}{C}}{<}\begin{matrix}H\\Br\end{matrix}$$

Perkin, Pope, and Wallach, in stating (*Proc.*, 1909, **25**, 83) that the constitutional formula of the unsaturated acid "comprises no atom which can be described as asymmetric, no matter which definition of an asymmetric atom be adopted," have overlooked the definition given by the author (*Phil. Mag.*, 1888, [v], **26**, 426). He there defined an asymmetric carbon atom as one which, when replaced by its image, gives a formula different from the original formula. This idea involved the consideration of an atom isolated from the rest of the molecule, and was justified in view of van't Hoff's theory (*Dix Années*, etc., 1887, pp. 27 and 28) that the tetrahedron the centre of which is occupied by the carbon atom acquires an asymmetric form owing to the effect of four different affinities on it; thus the asymmetrically deformed atom can be considered apart from the particular groups to which it is attached. The groups may be four or less, according as the atom is situated in open-chain or in one or more rings. The atom being asymmetric will have a non-superposable image. The replacement of the atom by its image was represented in the author's paper as brought about by an exchange of position of two of the groups attached to the atom. The same inversion may be done by flyping the tetrahedron (that is, by turning it inside out), a process applicable to the stereocentric benzene formulæ, and one which affords a simple explanation of the phenomenon called the Walden inversion. In this method of treatment there is no need for a kind of dissection of a formula, as employed by Everest to prove four different groups, a process which must become difficult when there are several asymmetric atoms in the molecule. The views expressed in the author's paper lead to the conclusion that the methyl*cyclo*hexylideneacetic acid has three asymmetric carbon atoms in the molecule (1), (4), and (7), and that all three remain asymmetric in the bromine additive compound.

The exchange of position of any two groups or linkings attached to C (1) in either acid gives a formula different from the original one, being, in fact, that of the optical isomeride. The case is the same with C (4) and C (7). The unsaturated acid is certainly a compound of a novel type, in that with three asymmetric carbon atoms there are only two possible isomerides, and those enantiomorphous.

A somewhat similar example of a limited isomerism is that of the trihydroxyglutaric acids, where also with three asymmetric carbon atoms there are only two isomerides which are here optically inactive (without including the active forms which have only two asymmetric atoms).

Perkin and Pope (*Trans.*, 1911, **99**, 1510) claim that in the methyl*cyclo*hexylideneacetic acid "the optical activity is due to the enantiomorphous configuration of the molecule as a whole." This is certainly true, not only of this acid, but of every optically active substance whatever, and the author stated it in the paper already mentioned. The converse has also proved true that unless the molecule as a whole is asymmetric it will be optically inactive, however many asymmetric atoms it may contain. The term "centroasymmetry" is therefore not only unnecessary, but misleading; and van't Hoff's original proposition with regard to carbon still holds good, that every optically active compound has an asymmetric atom in the molecule, although the presence of asymmetric carbon does not necessarily involve optical activity.

329. "Latent heats of vaporisation of mixed liquids. Part II." By Dan Tyrer.

In continuation of previous investigations (*Trans.*, 1911, **99**, 1633) it was pointed out that a mixture of two liquids has really two latent heats, namely, (1) heat absorbed when 1 gram of the mixture vaporises at constant temperature and pressure from an infinitely large quantity of the mixture of known composition. It is supposed that no change in the composition occurs in this process. (2) Heat absorbed when 1 gram of a mixture is completely vaporised at constant temperature. If x is the composition of the liquid in (1) and y the composition of the vapour which leaves it, and if y is also the composition of the 1 gram of liquid in (2), then it can be easily shown that:

$$(Lp)_x = (Lc)_y + H,$$

where Lp and Lc are the two latent heats respectively defined above, and H is the heat developed when 1 gram of the mixture of composition y is added to an infinitely large quantity of the liquid of composition x. Values of Lp for several mixtures have been experimentally determined, and also the compositions y of the vapour boiling off from mixtures of known compositions, and from this data values of Lc have been calculated. It was shown that whilst the results for Lp do not appear to bear any simple relation to the compositions of the mixtures, those for Lc follow Trouton's equation:

$$L_cM/T = \text{constant},$$

where M is the mean molecular weight of the mixture and T is the temperature.

330. "Influence of double linking on optical activity." By Percy Faraday Frankland and Hugh Henry O'Sullivan.

The authors have compared the relative rotatory effects of the allyl and n-propyl groups in the following pairs of compounds:

	In liquid state. $[M]_D^{20°}$.
Menthoxyacetic allylamide	−192·5°
Menthoxyacetic n-propylamide	193·7
Allyl menthoxyacetate	234·4
n-Propyl menthoxyacetate	234·1
Menthyl allylaminoacetate	160·5
Menthyl n-propylaminoacetate	158·3

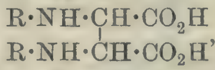
The differences in molecular rotation are thus very small; indeed, in the case of the allyl and propyl menthoxyacetates the allyl has slightly the higher rotation at low temperatures and the propyl compound at high temperatures.

In the case of the allyl- and propyl-amides of tartaric and malic acids previously investigated by one of the authors (*Trans.*, 1906, **89**, 1854 and 1861), the differences in rotation were much more pronounced, and in both instances the propyl compound had the higher rotation, thus:

	In pyridine solution.	
	$[M]_D^{20^\circ}$. Tartaric.	$[M]_D^{20^\circ}$. Malic.
Allylamide..............	+251°	−72·7°
n-Propylamide	+289	−90·5

These greater differences in rotation in the case of the tartaric and malic compounds are probably due to there only being three intervening atoms between the unsaturated and the asymmetric carbon atoms, whilst in the above menthyl compounds there are in all cases five intervening atoms between the unsaturated carbon atom of the allyl and the nearest asymmetric carbon of the menthyl group.

331. "The action of aliphatic amines on *s*-dibromosuccinic acid. Part I." By Edward Percy Frankland and Henry Edgar Smith.

The authors have prepared the dipropylamino- and dibutylamino-succinic acids,  $\begin{array}{c}R\cdot NH\cdot CH\cdot CO_2H\\ |\\ R\cdot NH\cdot CH\cdot CO_2H\end{array}$, by the action of *n*-propylamine and *n*-butylamine respectively on *s*-dibromosuccinic acid in alcoholic solution. The reaction appears to proceed in a manner analogous to that described by E. P. Frankland (*Trans.*, 1911, **99**, 1775) in the case of benzylamine and *s*-dibromosuccinic acid. The alkylamino-acids yield copper salts, hydrochlorides, and dinitroso-derivatives.

332. "The velocity of the reaction between iodic and sulphurous acids in various media." By Thomas Stewart Patterson and William Collins Forsyth.

The influence of methyl alcohol, ethyl alcohol, *n*-propyl alcohol, and of acetone on the velocity of the reaction between iodic acid and sulphurous acid was described.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Braccesco, *Giovanni.* La espositione di Geber Filosofo . . . , nella quale si dichiarano molti nobilissimi secreti della Natura. In Vinegia appresso Gabriel Giolito dé Ferrari 1562. pp. 160. (*Reference.*)
From Dr. J. N. Goldsmith.

Dunstan, *Albert Ernest,* and **Thole,** *Ferdinand Bernard.* Textbook of practical chemistry for technical institutes. pp. viii + 335. ill. London 1911. (*Recd.* 16/11/11.)
From the Publishers: Messrs. Methuen & Co., Ltd.

Espagnet, *Joannes d'.* Das Geheime Werck der Hermetischen Philosophie, Worinnen die natürlichen und künstlichen Geheimnüsse der Materie des Philosophischen Steins, wie auch die Art und Weise zu arbeiten richtig und ordendlich offenbahret sind. pp. [xii] + 90. [Wanting pp. 37–38, 71–72 and 87–88.] Leipzig 1685. (*Reference.*)
From Dr. J. N. Goldsmith.

Royal Society of London. Catalogue of a collection of early printed books in the Library. pp. 120. London 1910. (*Recd.* 20/11/11.)

II. *By Purchase.*

Barthel, *Chr.* Methods used in the examination of milk and dairy products. Translated by *W.* **Goodwin.** pp. xi + 260. ill. London 1910. (*Recd.* 20/11/11.)

Blount, *Bertram,* and **Bloxam,** *Arthur George.* Chemistry for engineers and manufacturers. 2nd edition. 2 vols. pp. xii + 392, xv + 513. ill. London 1911, 1910. (*Recd.* 17/11/11.)

Böttger, *Wilhelm.* Stand und Wege der analytischen Chemie. (Die chemische Analyse, Vol. XIII.) Stuttgart 1911. (*Recd.* 24/11/11.)

Höber, *Rudolf.* Physikalische Chemie der Zelle und der Gewebe. 3rd edition. pp. xv + 671. Leipzig 1911. (*Recd.* 25/11/11.)

Rideal, *Samuel.* Disinfection and the preservation of food. Together with an account of the chemical substances used as antiseptics and preservatives. 3rd edition. pp. xii + 494. ill. London 1903. (*Recd.* 17/11/11.)

Ubbelohde, *L.*, and **Goldschmidt,** *F.* Handbuch der Chemie und Technologie der Öle und Fette. Vol. III, part 2. pp. xiv + 381 to 1195. ill. Leipzig 1911. (*Recd.* 24/11/11.)

At the next Ordinary Scientific Meeting on **Thursday**, December **21st**, 1911, at **8.30** p.m., the following papers will be communicated:

"Investigations on the dependence of rotatory power on chemical constitution. Part II. The rotations of some secondary alcohols containing the *iso*propyl group." By R. H. Pickard and J. Kenyon.

"The alcohols of the hydroaromatic and terpene series. Part II. The menthols corresponding with optically inactive menthone." By R. H. Pickard and W. O. Littlebury.

"The absorption spectra of quinine, cupreine, 6-methoxyquinoline and 6-hydroxyquinoline." By J. J. Dobbie and J. J. Fox.

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[*Issued* 30/12/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 394.

Thursday, December 21st, 1911, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Messrs. Hugh Marshall and C. H. K. Gonville were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Fred Barrow, M.Sc., Ph.D., Birkbeck College, Bream's Buildings, E.C.
David Brownlie, B.Sc., 41, Corporation Street, Manchester.
Thomas Alfred Brunjes, 49, St. Donatts Road, New Cross, S.E.
Sidney Waterfield Bunker, B.Sc., 30, York Street, Twickenham.
Tom Peach Colclough, M.Sc., 47, Vicar Lane, Woodhouse, Sheffield.
Cornelius Durham Garbutt, 2, Hartington Road, Garston, Liverpool.
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Richard Ernest Gibbins, Clytha, Quinton Road, Coventry.
Rupert William Pope, B.Sc., 10, Malpas Road, Brockley, S.E.
Howard Vincent Potter, Rosemount, Pollard Road, Whetstone, N.

Alfred Reginald Roberts, c/o Canada Cement Co., Shallow Lake, Ontario.
Richard Smith, 6, Essex Road, Gorton, Manchester.
John Kerfoot Wood, D.Sc., 7, Airlie Terrace, Dundee.

A certificate has been authorised by the Council for presentation to ballot under Bye-Law I (3) in favour of John Duncan, Victoria Street, Waterloo, Sydney, N.S.W.

The PRESIDENT announced that the Longstaff Medal (1912) had been awarded to Dr. H. Brereton Baker, F.R.S.; the actual presentation would be made at the Annual General Meeting of the Society in March, 1912.

Of the following papers, those marked * were read:

***333. "Investigations on the dependence of rotatory power on chemical constitution. Part II. The rotations of some secondary alcohols containing the *iso*propyl group." By Robert Howson Pickard and Joseph Kenyon.**

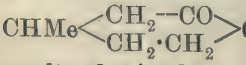
The authors have continued their investigations (*Trans.*, 1911, **99**, 45), and six alcohols of the general formula

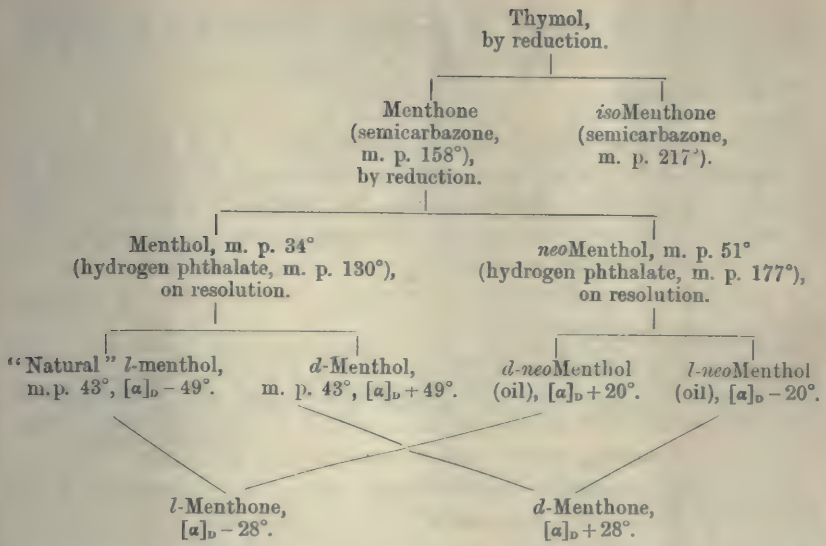
$$\mathrm{CHMe_2{\cdot}CH(OH){\cdot}R},$$

where R = methyl, ethyl, *n*-propyl, *n*-amyl, *n*-hexyl, or *n*-octyl, were described.

The specific rotations at 20° of the dextrorotatory forms of these alcohols are: *Methyl*iso*propylcarbinol*, $[\alpha]_D$ +4·8°; *ethyl*iso*propylcarbinol*, $[\alpha]_D$ +15·1°; *propyl*iso*propylcarbinol*, $[\alpha]_D$ +21·2°; n-*amyl*iso*propylcarbinol*, $[\alpha]_D$ +22·7°; n-*hexyl*iso*propylcarbinol*, $[\alpha]_D$ +21·5°, and n-*octyl*iso*propylcarbinol*, $[\alpha]_D$ +18·5°.

***334. "The alcohols of the hydroaromatic and terpene series. Part II. The menthols corresponding with optically inactive menthone." By Robert Howson Pickard and William Oswald Littlebury.**

The authors described an investigation of the relationship existing between the menthols produced by the reduction of one of the two optically inactive stereoisomerides, which have the formula  $\mathrm{CHMe}<\begin{matrix}\mathrm{CH_2{-}CO}\\\mathrm{CH_2{\cdot}CH_2}\end{matrix}>\mathrm{CHPr^{\beta}}$. The following diagram shows the results obtained:



d-*neo*Menthol was found in some residues, which were kindly presented to the authors by Messrs. Schimmel & Co., who obtained the same after working up large quantities of Japanese peppermint oil for *l*-menthol.

*335. "The absorption spectra of quinine, cupreine, 6-methoxyquinoline, and 6-hydroxyquinoline." By James Johnston Dobbie and John Jacob Fox.

In a paper dealing with the absorption spectra of cinchonine, quinine, and their isomerides (*Trans.*, 1911, **99**, 1254), it was shown that the absorption spectra of cinchonine and quinoline are practically identical, the reduced half of the cinchonine molecule having little effect on the spectrum. The absorption spectra of quinine and cupreine have now been compared with those of 6-methoxyquinoline and 6-hydroxyquinoline, with similar results.

The four spectra resemble one another very closely. They exhibit three bands each, the principal band having its head at about $1/\lambda 3050$, and the two others at about $1/\lambda 3500$ and $1/\lambda 3750$ respectively. The chief difference between the spectra of quinine and cupreine on the one hand, and those of methoxyquinoline and hydroxyquinoline on the other, lies in the somewhat greater absorption exhibited by the alkaloids. The hydrochlorides of quinine and 6-methoxyquinoline also yield absorption spectra which are nearly identical. Those given by $N/100$-solutions of quinine sulphate and methoxyquinoline sulphate (both fluorescent solutions) differ only in the greater general absorption of the former.

*336. "Amino-derivatives of arylsulphonanilides and arylsulphon-β-naphthalides." By Gilbert T. Morgan and Frances M. G. Micklethwait.

The toluene-*p*-sulphonyl derivatives of the *m*- and *p*-nitroanilines are readily methylated with methyl halides in alcoholic soda or potash, and the corresponding as-*toluene*-p-*sulphonylmethyl*-m(and p)-*phenylenediamines* are produced by the reduction of these toluene-*p*-sulphonylmethylnitroanilines. The diazonium salts of the new bases furnish azo-colours dying on wool or silk by coupling with various naphtholsulphonic acids.

Toluene-*p*-sulphon-β-naphthalide yields on nitration, not only toluene-*p*-sulphonyl-1-nitro-β-naphthylamine, but also *toluene*-p-*sulphonyl*-1 : 6-*dinitro-β-naphthylamine.* The former of these nitro-derivatives is readily methylated, the latter only with some difficulty.

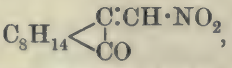
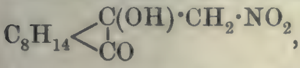
The amines produced by reducing these nitro-compounds and their alkyl derivatives were described, together with a similar series of compounds derived from β-naphthylamine-6-sulphonic acid.

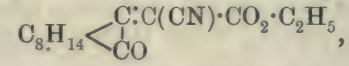
337. "The action of nascent hydrogen on nitric acid." By Manindra Nath Banerjee and Satish Chandra Banerjee.

Veley, in explaining the action of nitric acid on metals (*Proc. Roy. Soc.*, 1890, **46**, 216; 1893, **52**, 27; *Phil. Trans.*, 1891, *A*, 312; *J. Soc. Chem. Ind.*, 1891, **10**, 204), states that the action is due to nitrous acid and to its mass present in the solution. He believes that the action is started with mere traces of nitrous acid, always present in the original acid. He is not in favour of the nascent hydrogen theory advanced by certain chemists. The authors find that nascent hydrogen has rapid action on nitric acid, first decomposing it (acting catalytically), and then reducing it to the lower oxides of nitrogen, and finally to ammonia. This argument has been further extended to explain the action of nitric acid on metals, in which the authors have attempted to prove that it is the nascent hydrogen, and not nitrous acid, that is responsible for the formation of various reduction products. The reaction is found to depend entirely on the capacity of metals to decompose water, and the authors confirm the views of Montemartini as to the relation of the action of nitric acid on metals to that of metals on water (liberating hydrogen), namely, that those metals which decompose water at a high temperature give with nitric acid, nitrogen peroxide, trioxide, and dioxide; whilst those that decompose water at a low temperature give, in addition to the above, nitrous oxide, nitrogen, and ammonia; and, lastly, those decomposing water at the ordinary temperature also evolve hydrogen.

Nascent hydrogen was obtained from platinum-black which had occluded the gas. The experiments showing the interaction between nitric acid and the platinum-black on the one hand, and the absorption of the products by suitable reagents on the other, were conducted in a suitably arranged apparatus. The interaction of the nascent hydrogen and nitric acid results in the ready decomposition of the acid and formation of various reduction products, the free oxygen being wholly converted into water.

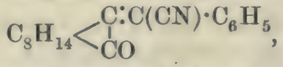
338. "Studies in the camphane series. Part XXXI. Condensation of camphorquinone with nitromethane, ethyl cyanoacetate, and phenylacetonitrile." By Martin Onslow Forster and John Charles Withers.

Nitromethylenecamphor,  $C_8H_{14}\left<\begin{array}{l}C{:}CH\cdot NO_2\\ \mid\\ CO\end{array}\right.$, prepared from camphorquinone and sodionitromethane in alcohol, melts at 77°, and is immediately resolved into its factors by warm aqueous alkali; under certain conditions it is accompanied by *nitromethylhydroxycamphor*,  $C_8H_{14}\left<\begin{array}{l}C(OH)\cdot CH_2\cdot NO_2\\ \mid\\ CO\end{array}\right.$, which melts at 104°, and also gives camphorquinone with hot alkali hydroxide. *Ethyl camphorylidenecyanoacetate* (*ethyl methylenecamphorcyanocarboxylate*),



$$C_8H_{14}\left<\begin{array}{l}C{:}C(CN)\cdot CO_2\cdot C_2H_5\\ \mid\\ CO\end{array}\right.,$$

produced by the influence of sodium ethoxide (0·05 mol.) on an alcoholic mixture of camphorquinone and ethyl cyanoacetate, forms lustrous, sulphur-yellow prisms, melting at 97°. The corresponding *acid*, $C_{13}H_{15}O_3N$, melts at 141—143°, and the *methyl* ester, $C_{14}H_{17}O_3N$, at 81°. *Phenylcyanomethylenecamphor*,



$$C_8H_{14}\left<\begin{array}{l}C{:}C(CN)\cdot C_6H_5\\ \mid\\ CO\end{array}\right.,$$

obtained from camphorquinone and phenylacetonitrile with a small proportion of sodium ethoxide, crystallises in massive, yellow prisms, melting at 166°.

When ethyl camphorylidenecyanoacetate is treated with hydrogen peroxide, hydrolysis of the cyano-group takes place simultaneously with oxidation. The resulting *amide-ester*, $C_{15}H_{21}O_6N$, melts at 209°, and is accompanied by the *amide-acid*, $C_{13}H_{17}O_6N,H_2O$, melting at 205°. Both substances, on complete hydrolysis, yield the dibasic *acid*, $C_{13}H_{16}O_7$, which melts at 231°.

339. "Solutions of halogen double salts in water and ether." By James Ernest Marsh.

The capability of the halogen double salts to give homogeneous solutions in a mixture of ether and water is limited, on the one hand, by the too great solubility of the salt in one of the solvents, and on the other by the too slight solubility of the salt in both solvents. Sodium, potassium, rubidium, and barium mercuri-iodides give with ether and water homogeneous solutions, which on warming separate into three layers; the lithium and ammonium salts are very soluble in ether with a little water, and leave the excess of water undissolved; the cæsium salt is only sparingly soluble, and has but little effect on a mixture of ether and water. Of the bromides, ammonium mercuribromide, and of the chlorides, lithium mercurichloride are the only inorganic salts of this sort which have been found to give homogeneous solutions, separating on warming into three layers. Potassium mercurichloride resembles cæsium mercuri-iodide, and has but little action. So far as they have been examined, the salts of primary amines resemble the salts of ammonium, whilst tetramethylammonium mercuri-iodide resembles the cæsium salt, and has even less action.

340. "The relation between the absorption spectra of metallic ions and their valency." By Cecil Reginald Crymble.

The absorption spectra of the aqueous solution of more than thirty metals have been examined. It has been found that the metals of constant valency give solutions which are non-absorptive provided that a salt is employed, the acidic radicle of which is itself diactinic. On the other hand, the metals which vary in valency yield absorptive solutions. A connexion has also been shown to exist between the absorptive properties of solution of metals and the chemical and physical properties of the metals.

341. "The solubility of electrolytes in aqueous solutions. Part II. Solubility of oxalic acid in other acids." By James Irvine Orme Masson.

In extension of previous work, which dealt with salts in acid solution (Trans., 1911, **99**, 1132), measurements have been made of the solubility at 30° of oxalic acid in solutions of nitric and of hydrochloric acids.

In both cases the solubility falls to a minimum as the concentration of solvent acid rises, after which it increases. In nitric acid solutions this increase is terminated by conversion of the solid oxalic acid into the anhydrous compound, the solubility of which then falls to a second minimum. The concentration of nitric acid at the transition point is about that of "constant boiling point" acid.

The solubility curves of the dihydrate in both acids are conic in form, and in this respect resemble certain other solubility curves.

The assumption of constant molecular volume in solution, which was found to be valid in the earlier cases studied, holds also in these instances.

Supplementary determinations were made with β-naphthalenesulphonic acid in hydrochloric acid solution. The curve obtained resembles those for the salt-acid examples.

342. The determination of sulphur in petroleum."
By James McConnell Sanders.

The Mahler or Hempel calorimetric bomb method for estimating the total sulphur in petroleums, although trustworthy, is somewhat lengthy, since the gaseous combustion products must be absorbed, and when samples poor in sulphur are under treatment, several combustions must be made. The Parr calorimeter is not available for petroleums on account of the small amount of sample which can be treated.

The author described a method by which a large sample may be concentrated by treatment with fuming nitric acid and potassium bromide, the product being absorbed by magnesium oxide, which enables it to be readily removed from the concentrating dish, and burnt in the Parr apparatus with sodium peroxide. Several samples may be treated simultaneously, the final combustion taking about forty-five seconds.

Test analyses were given, comparing results with the Mahler bomb method. For samples poor in sulphur a modified lamp method was described, in which a larger sample is completely burnt, thus avoiding the errors in the usual method owing to the sulphur being given off in an irregular manner.

Some Mexican and Texan kerosenes contain loosely combined sulphur, which decomposes when heated or when in contact with some metals, such as copper; since samples have been known to blister, and even perforate, a copper lamp, the testing of commercial kerosenes for such unstable sulphur was recommended. The author described a qualitative and quantitative method for the purpose.

For the manipulation of the small precipitates of barium sulphate obtained in these operations, the author described a rapid suctionfilter method, in which the amount of filter-paper is reduced to a minimum, and the weighing conducted in a very light dish. For the simultaneous treatment of several precipitates a special arrangement of the apparatus was described.

ADDITIONS TO THE LIBRARY.

II. *By Purchase.*

Nernst, *Walter.* Theoretical chemistry from the standpoint of Avogadro's rule and thermodynamics. Revised in accordance with the sixth German edition by *Henry Thomas* **Tizard.** pp. xix + 810. London 1911. (*Recd.* 16/12/11.)

Schidrowitz, *Philip.* Rubber. pp. xv + 303. ill. London 1911. (*Recd.* 20/12/11.)

Weimarn, *P. P. von.* Grundzüge der Dispersoidchemie. pp. viii + 127. ill. Dresden 1911. (*Recd.* 16/12/11.)

The next Ordinary Scientific Meeting will be held on **Thursday,** January **18th,** 1912, at **8.30** p.m.

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The Ordinary Scientific Meetings for 1911-12 will be held on the following Thursdays at 8.30 p.m. :—

October 19th, 1911
November 2nd, ,,
,, 16th,* ,,
December 7th, ,,
,, 21st,* ,,
January 18th,* 1912
February 1st, ,,
,, 15th,* ,,

March 7th, 1912
,, 21st,* ,,
April 18th,* ,,
May 2nd, ,,
,, 16th,* ,,
June 6th, ,,
,, 20th,* ,,

*Council Meetings will be held on these days.

Annual General Meeting, Thursday, March 28th, 1912, at 4.30 p.m.

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HAROLD BAILY DIXON, M.A., Ph.D., F.R.S.	1909–1911

THE CHEMICAL SOCIETY.

THE Chemical Society was founded on February 23rd, 1841, and its first General Meeting was held on March 30th of that year. In 1848 a Charter of Incorporation was granted to the Society by the Crown, under the conditions of which it consists of Fellows, Honorary and Foreign Members, and Associates.* The Fellows elect out of their own body a Council consisting of a President, Vice-Presidents, a Treasurer, two Secretaries, a Foreign Secretary, and twelve other Fellows, by whom the business of the Society is conducted.

The object of the Society, as laid down in the Charter, is the general advancement of Chemical Science, by the discussion and publication of new discoveries, and the interchange of valuable information respecting them.

A Candidate for election as a Fellow of the Chemical Society must send to the Secretaries a Certificate subscribed by not less than five Fellows of the Society, to three at least of whom he must be personally known.† The Certificate will be read at three Ordinary Meetings of the Society, and the Candidate will afterwards be balloted for. When elected, he will receive notice thereof from the Secretaries.

Each Fellow has the right to be present and to vote at all Meetings of the Society, and to propose Candidates for admission into the Society, and is entitled to one copy of the Annual Publications so long as his Annual Subscription be not in arrear. He is also entitled to the use of the books in the Society's Library, under such restrictions as the Council may deem necessary. He has the privilege of introducing to Ordinary Scientific Meetings of the Society, two visitors, whose names are entered in a book kept for that purpose, together with the name of the Fellow introducing such visitors.

When elected, every Candidate previous to admission is required, within three months from the date of his election, to pay an admission fee of £4, and either his first annual subscription, or his life composition fee; otherwise his election becomes void. The annual subscription to be paid by Fellows is £2. The subscriptions of Fellows become due on the first day of January of every year. The life composition fee is £30, excepting that Fellows who have paid ten annual subscriptions pay as life composition fee £20; Fellows who have paid fifteen annual subscriptions pay £15; Fellows who have paid twenty annual subscriptions pay £12; and Fellows who have paid twenty-five annual subscriptions pay £10.

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* No elections of Associates have taken place for many years.

† In the case of Candidates resident abroad unable to obtain this number of signatures, the Council have power to accept a certificate signed from personal knowledge by one Fellow of the Society, and to recommend its presentation for ballot.

If a Candidate be elected during the month of November or December, he will not be called upon to pay any annual subscription for the current year, and will not be entitled to receive the publications of the Society for that year.

Any Fellow who at the period of the Annual General Meeting of the Society in March owes two annual subscriptions, such subscriptions having been duly applied for, and no reason satisfactory to the President and Council having been assigned for their non-payment, shall cease to be a Fellow of the Society, and his name will be removed from the Society's List accordingly: Provided, nevertheless, that on a solicitation for re-admission being addressed to the President and Council by a person so circumstanced, the case of such person will be considered by the Council, who may, if they see fit, reinstate him as a Fellow of the Society, upon his paying the arrears of his subscription, or a life composition fee.

COMMUNICATION OF PAPERS.

All communications for the Journal and for the Proceedings of the Society should be addressed to "The Secretaries, Chemical Society, Burlington House, W."

The Council have decided that no communication shall be included in the list of titles of papers to be brought before a Meeting of the Society, unless it is in the hands of the Secretaries at least three days before the date of the Meeting. No announcement of titles can be made in the Proceedings until the communications have been received by the Secretaries. Papers which, on the report of referees, are deemed by the Council unsuitable for publication in the Transactions, are deposited in the Society's Archives. Authors are advised, therefore, to retain copies of their papers.

In all cases, an abstract of the paper, not exceeding three hundred words in length, should be supplied for insertion in the Proceedings.

Communications are put down on the list for reading in the order in which they are received.

Communications which have already appeared in any foreign journal will not be published in the Society's Transactions, unless this course is specially recommended by the Publication Committee and this recommendation approved by the Council.

PUBLICATIONS OF THE SOCIETY.

With the exception of certain numbers of the Journals and Proceedings which are out of print, the following publications may be obtained from Messrs. Gurney and Jackson, 33, Paternoster Row, E.C. :

		Price to Fellows.			Price to Public.		
		£	s.	d.	£	s.	d.
Memoirs and Proceedings, 1841-1847 (3 Vols.)	per vol.	1	0	0	1	10	0
Quarterly Journal, 1848-1862 (14 Vols.)	per vol.	1	0	0	1	10	0
,, ,, ,, ,, (Single Parts)	per part		5	0		7	6
Journal, 1862–1895	per vol.	1	10	0	1	10	0
,, ,, ,, (Single Parts)	per part		2	6		2	6
,, 1896 to present date	per vol.	2	0	0	2	0	0
,, ,, ,, (Single Parts)	per part		3	6		3	6
Proceedings, 1885 to present date	per vol.		7	6		7	6
,, ,, ,, (Single Parts)	per part			6			6
Annual Reports on the Progress of Chemistry (bound in cloth), Vols. I (1904) to present date	per vol.		4	6		4	6
Collective Index, Vol. I. 1841–1872	per vol.		4	0		4	0
* ,, ,, ,, II. 1873–1882	per vol.		10	0		15	0
* ,, ,, ,, III. 1883–1892	per vol.		15	0	1	0	0
* ,, ,, ,, IV. 1893–1902	per vol.	1	0	0	1	10	0
†Jubilee Volume, 1891			6	0		6	0
†Memorial Lectures, 1893–1900			7	6		7	6
†Library Catalogue, 1886			1	0		1	0
† ,, ,, 1903			2	6		2	6
†Cases for binding the Journal in 4 vols.	per year		4	0		4	0

Tables of International Atomic Weights (as recommended by the International Atomic Weights Committee). 1/6 per doz. ; 12/- per hundred.

* Postage to Fellows One Shilling extra.
† Post free to Fellows.

The *Journal*, which is published on the last day of each month, includes the Transactions of the Chemical Society and Abstracts of chemical papers published in other Journals.

The *Proceedings* contain certain papers read at the meetings and abstracts of the remainder and of the discussions. They are, as a rule, issued to the Fellows about a week after each Ordinary Scientific Meeting.

The Annual Reports on the Progress of Chemistry contain an epitome of the principal definite steps in advance which have been made during the year. Cases for binding the Annual Reports can be obtained from the Assistant Secretary, price One Shilling each.

RESEARCH FUND.

The Research Fund of the Chemical Society has been established for the purpose of assisting investigators by defraying the cost of expensive materials. The income accruing from the munificent donations received from the Goldsmiths' Company and from the Perkin Memorial Fund will be devoted as far as possible to the encouragement of research in (*a*) metallurgical and inorganic chemistry and (*b*) the chemistry of coal-tar products, respectively.

The Committee meets twice a year to consider applications for grants; and forms of application, which can be obtained from the Assistant Secretary, must be lodged with the Secretaries by the end of May and November in each year.

NAMES OF HONORARY AND FOREIGN MEMBERS.

NUMBER NOT TO EXCEED FORTY.

Date of Election.	
Jan. 20, 1898	Arrhenius, Prof. Dr. Svant August, F.R.S., Bergsgaten 18, Stockholm
May 18, 1876	Baeyer, Geh. Rath Prof. Dr. Adolph von, F.R.S., Arcis-str. 1, Munich
March 2, 1911	Bamberger, Prof. Dr. Eugen, Germaniastrasse 51, Zürich IV, Switzerland
Feb. 2, 1888	Boisbaudran, Lecoq de, Rue de Longchamp 113, Passy, Paris
March 2, 1911	Ciamician, Prof. Giacomo, Regia Universita, Bologna, Italy
May 18, 1904	Clarke, Prof. Frank Wigglesworth, LL.D. (Aberd.), United State Geological Survey, Washington, D.C., U.S.A.
May 18, 1904	Curie, Madame Marie, La Sorbonne, Paris
Jan. 20, 1898	Curtius, Geh. Rath Prof. Dr. Theodor, Universität, Heidelberg
June 16, 1892	†Fischer, Geh. Rath Prof. Dr. Emil, F.R.S., Hessischestrasse 1, Berlin, N., Germany
Jan. 20, 1898	Franchimont, Prof. Dr. Antoine Paul Nicolas, Rapenburg 104, Leyden
Feb. 6, 1908	Gautier, Prof. Armand Emile Justin, 9, Place-des-Vosges, Paris
June 16, 1892	Graebe, Prof. Dr. Carl, Westendstrasse 28, Frankfurt-am-Main, Germany
March 2, 1911	Groth, Prof. Dr. Paul Heinrich Ritter von, The University, Munich
Feb. 6, 1908	Haller, Prof. Albin, 10, Rue-Vauquelin, Paris
Feb. 6, 1908	Hittorf, Dr. Johann Wilhelm, Westfälische Wilhelms-Universität, Münster, Westfalen, Prussia
Jan. 20, 1898	Körner, Prof. Wilhelm, R. Scuola Superiore d'Agricoltura, Milan
Feb. 6, 1908	Le Bel, Joseph Achille, 250, Rue Saint Jacques, Paris
Feb. 6, 1908	Le Chatelier, Prof. Henri Louis, 73, Rue Notre Dame des Champs, Paris
June 16, 1892	Lieben, Prof. Dr. Adolph, Mölkerbastei 5, Vienna I., Austria
May 18, 1904	Liebermann, Geh. Rath Prof. Dr. Carl, Matthäikirchstrasse 29, Berlin, W., Germany
March 4, 1909	Lunge, Georg, Prof., Ph.D. (Breslau), Hon. Dr. Ing. (Karlsruhe), Carmenstrasse 37, Zürich, Switzerland
March 2, 1911	Mallet, John William, Prof. Ph.D. (Göttingen), M.D. (Louisiana), LL.D. (Princetown, Penn., and Johns Hopkins), F.R.S., University of Virginia, Virginia, Albermarle Co., Va., U.S.A.
May 18, 1904	Morley, Prof. Edward Williams, Hon. D.Sc. (Yale), West Hartford, Conn., U.S.A.
March 2, 1911	Nernst, Geh. Rath Prof. Dr. Walther, Karlsbad 26A, Berlin W. 35, Germany

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† Faraday Lecturer, 1907.

Date of Election.	
Jan. 20, 1898	*Ostwald, Geh. Rath Prof. Dr. Wilhelm, LL.D. (Aberd.), Grossbothen, Kgr., Sachsen
Jan. 20, 1898	Remsen, Prof. Ira, Johns Hopkins University, Baltimore, U.S.A.
Feb. 6, 1908	†Richards, Prof. Theodore William, S.B. and Hon. LL.D. (Haverford), A.M., Ph.D. and Hon. D.Sc. (Harvard), Hon. Sc.D. (Yale), Hon. Ph.D. (Prague), Hon. Chem. D. (Clark Univ.), Hon. M.D. (Berlin), Hon. D.Sc. (Cantab), Harvard University, Cambridge, Mass., U.S.A.
June 16, 1892	Schiff, Prof. Dr. Hugo, Via Gino Capponi 3, Florence, Italy
June 16, 1892	Schlœsing, Prof. Dr. Théophile, Institut Agronomique, Paris
Jan. 20, 1898	Troost, Prof. Louis Joseph, Rue Bonaparte 84, Paris
Jan. 20, 1898	Waals, Prof. Dr. Johannes Diderik van der, T.C., Hooftstraat 117, Amsterdam
Feb. 6, 1908	Wallach, Prof. Dr. Otto, Königl. Georg August Universität, Göttingen Prussia.

* Faraday Lecturer, 1904.
† Faraday Lecturer, 1911.

FARADAY LECTURERS.

1869. Jean Baptiste André Dumas.
1872. Stanislao Cannizzaro.
1875. August Wilhelm von Hofmann.
1879. Charles Adolphe Wurtz.
1881. Hermann Ludwig Ferdinand von Helmholtz.
1889. Dmitri Ivanovitsch Mendeléeff.
1895. Lord Rayleigh.
1904. Wilhelm Ostwald.
1907. Emil Fischer.
1911. Theodore William Richards.

LONGSTAFF MEDALLISTS.

1881. Thomas Edward Thorpe.
1884. Cornelius O'Sullivan.
1888. William Henry Perkin.
1891. Francis Robert Japp.
1894. Horace Tabberer Brown.
1897. William Ramsay.
1900. William Henry Perkin, jun.
1903. William Jackson Pope.
1906. Walter Noel Hartley.
1909. Frederic Stanley Kipping.

In order that the List of Fellows may be as complete as possible, those Fellows whose names and degrees do not appear in full are requested to communicate with the Assistant Secretary. Inaccuracies and changes of Address should be reported without delay on the form attached.

NAMES OF FELLOWS.

‖ Denotes Life Members.
Trans. Denotes Members who have contributed Papers published in the Society's Transactions.
Proc. " " " " " " " " Proceedings.
C. " " " served on Council of the Society; P. as President; V.P. as Vice-President; T. as Treasurer; S. as Secretary; F.S. as Foreign Secretary.

Date of Election.			
1903	Trans.		Abell, Robert Duncombe, D.Sc. (Wales), Ph.D. (Leipzig), F.I.C., University College of South Wales and Monmouthshire, Cardiff
1871	Trans.	C. 1882-4	Abney, Sir William de Wiveleslie, K.C.B., Hon. D.C.L. (Dun.), Hon. D.Sc. (Vict.), Sc.D. (Dub.), F.R.S., F.I.C., Rathmore Lodge, Bolton-gardens-south, S.W.
1883			Abraham, Alfred Clay, F.I.C., 87, Bold-street, Liverpool
1890			‖Abrines, Gustavus Anthony, Sanitary Commissioner's Office, Gibraltar
1911			Acree, Solomon Farley, Johns Hopkins University, Baltimore, Md., U.S.A.
1875	Trans.		Acworth, Joseph John, Ph.D. (Erlangen), F.I.C., Thornbank, Shootup-hill, Brondesbury, N.W.
1905			Adam, Adam Lawson Kelly, c/o Dalgety & Co., Ltd., 15, Bent-street, Sydney, N.S.W.
1892			Adams, Arthur, F.I.C., 66, Edgbaston-road, Smethwick
1877	Trans.		‖Adams, Matthew Algernon, F.R.C.S. (Eng.), F.I.C., The Kulm, Bearsted, near Maidstone
1910			Adams, Percival Frederick, 81, Rock-avenue, Gillingham, Kent
1892			Adcock, Samuel Robert, The St. Helens Smelting Co., Atlas-court, St. Helens
1896			Addie, Robert, Suffolk House, Laurence Pountney Hill, E.C.
1911			Adendorff, John Ernest Roux, P.O. Box 159, Randfontein, Transvaal, S. Africa
1881	Trans.		Adeney, Walter Ernest, Hon. D.Sc. (R.U.I.), A.R.C.S.I., F.I.C., Burnham, Queen's-park, Monkstown, Co. Dublin
1885	Trans.		Adie, Richard Haliburton, M.A. (Cantab.), B.Sc. (Lond.), 136, Huntingdon-road, Cambridge

Date of Election.			
1909	Trans.		Adlam, George Henry Joseph, B.A. and B.Sc. (Oxon.), The Grammar School, Leeds
1885			Adriance, John Sabine, Ph.D., Williams College, Williamstown, Mass, U.S.A.
1906			Agar, Shelton Gottlieb, La Fontaine, Clifton, Guernsey, Channel Islands
1909			Aiyer, Yegna Narayan, M.A. (Madras), 2, Pike's-walk, Cambridge
1908			Akers, Noel Charles, A.I.C., 26, King's-avenue, Muswell Hill, N.
1879			Albright, George Stacey, M.A. (Cantab.), Bromesberrow-place, Ledbury
1893			Albuquerque, John Pedrozo d', Prof., M.A. (Cantab.), F.I.C., Government Laboratory, Barbados, West Indies
1892			Alcock, John While, Central Brewery, 45, Mott-street, Birmingham
1902			Alder, John Frederick, 28, Claverly-grove, Church-end, Finchley, N.
1903			Alderton, Gilbert John, B.Sc. (Lond.), F.I.C., 46, Westmount-road, Eltham Park, Kent
1911			Allan, James, M.A , and B.Sc. (Lond.). Ravenscourt, Lerwick, Shetland Isles
1886			Allan, James Henry, L.R C.P. and L.R.C.S. (Edin.), 45, Walton-vale, Liverpool
1896			Allan, John, 77, Northern-grove, West Didsbury, near Manchester
1907			Allan, John Campbell, 91, Norse-road, Scotstoun, Glasgow
1907			Allen, Alfred Frederick, B.Sc. (Lond.) 35, Purrett-road, Plumstead, S.E.
1894			Allen, Frederick John, Phœnix Chemical Works, Upper North-street, Poplar, E.
1901			Allen, Frederick Thomas, B.Sc. (Dun.), The Grammar School, Ramsey, Huntingdon
1870			Allen, John, Phœnix Chemical Works, Upper North-street, Poplar, E.
1904			Allen, William Harold Richard, c/o Straits Trading Co., Butterworth, Penang, Straits Settlements
1894			Allibon, George Henry, Mayfield, Lisburn-road, Balmoral, Belfast
1905			Allison, James Albert, Luchana Laboratory, Apartado 45, Bilbao, Spain
1908	Trans.		Allmand, Arthur John, D.Sc. (L'pool), Institut für Wissenschaflliche Photographie, Technische Hochschule, Dresden, Germany
1899			Allworthy, James Herbert, 41, Comyn-road, Wandsworth Common, S.W.
1899		||	Allworthy, Samuel William, M.A., M.D., B.Ch., L.M. and D.P.H. (Dub.), The Manor House, Antrim-road, Belfast

Date of Election.		
1903		Alton, William Lester St. John, F.I.C., 42, The Manor House, Marylebone, N.W.
1885	Proc.	‖Amphlett, Edward Greenhill, M.A. (Oxon.), 3, Union-place, Worthing
1911		Anderson, Edward, Hill View House, Waun Wen-road, Swansea
1890		Anderson, Frederic Alfred, B.Sc. (Lond.), F.I.C., 24, Grainger-street-west, Newcastle-on-Tyne
1895		Anderson, Herbert, The Blue School, Wells
1899		Anderson, James William, Madras Cement Works, Royapuram, Madras, India
1906		Anderson, Robert, Chester-road-west, Sunderland
1901	Trans.	Anderson, William Carrick, M.A., D.Sc. (Glas.), 7, Scott-street, Garnethill, Glasgow
1892		Anderson, William Smellie, Christmas Island, Straits Settlements
1908		Andreae, Edward Philip, Ph.D. (Berlin), c/o The British Glanzstoff Manufacturing Co., Ltd., Flint
1905	Trans.	Andrews, Albert Edward, St. Hilda, 20, Carew-road, Thornton Heath, Surrey
1888		Andrews, Edward Arthur, St. Mary's Hospital, Paddington, W.
1882		‖Andrews, Launcelot Winchester, Ph.D. (Göttingen), 1719, Rock Island-street, Davenport, Iowa, U.S.A.
1905	Trans.	Angel, Andrea, M.A. and B.Sc. (Oxon.), 17, Banbury-road, Oxford
1877		Angell, John, F.I.C., 6, Beacon's-field, Derby-road, Withington, Manchester
1909		Anklesaria, Jehangir Dhanjishaw, Ahmedabad, India
1898	Trans.	Annable, Henry William Coupe-, Gresham House, Egham, Surrey
1909		Annett, Harold Edward, B.Sc. (Lond.), Agricultural Research Institute, Pusa, Bengal, India
1905		Anthony, Charles, jun., M.Inst. C.E., Casilla de Correo, 149, Bahia Blanca, Argentine, S. America
1910	Trans.	Applebey, Malcolm Percival, Hill View, Foxcombe, Boar's Hill, Oxford
1879		‖Appleby, Herbert, 2, John Dalton-street, Manchester
1903		Appleyard, George Henry, F.I.C., Arnold House, Burton-road, Hornsea, Hull
1890	Trans.	Appleyard, James Robert, Royal Technical Institute, Salford
1903		‖Appleyard, Percy, Albany, Western Australia
1884		Archbutt, Leonard, F.I.C., The Yews, Madeley-street, Derby
1875		Armistead, William, M.B. and C.M. (Edin.), Stapleford, Cambridge
1900	Proc.	Armitage, Francis Paul, 13, Palliser-road, West Kensington, W.
1903	Trans.	‖Armstrong, Edward Frankland, D.Sc. (Lond.), Ph.D. (Berlin), F.C.G.I., c/o Messrs. Huntley & Palmers, Reading

Date of Election.			
1899			Armstrong, Frederick William, 24, Portman-avenue, East Sheen, S.W.
1870	Trans.	C.1873-5 S. 1875-93 P.1893-5	‖Armstrong, Henry Edward, Prof., LL.D. (St. Andrews), Ph.D. (Lips.), F.R.S., 55, Granville-park, Lewisham, S.E.; and Central Technical College, Exhibition-road, S.W.
1909			Armstrong, James Alexander Haddon, B.A., c/o Mr. J. Flynn, Thornton's-avenue, Sea View, Natal, S. Africa.
1905			Arnaud, Francis William Frederick, F.I.C., Chemical Laboratory, 16, Arundel-street, Portsmouth
1909			Arnfield, Harold, Peak Lodge, Buxton-road, Stockport
1906	Trans.		Arup, Paul Seidelin, M.A. (Nova Scotia), B.Sc. (Lond.), 17, Broadway, Southall
1903			Ashdown, Herbert Henry, 88, Southgrove-road, Sheffield
1911			Ashe, Albert, Lawrie-square, Romford
1900			Ashton, James, Hill House, Chapelfield, Radcliffe, Manchester
1901			Aspinall, Thomas, 62, Gilnow-road, Bolton
1900	Trans.		Aston, Bernard Cracroft, F.I.C., 71, Devon-street, Wellington, New Zealand
1901	Trans.		Aston, William George, The Square, Valentines-park, Ilford, E.
1911			Atkins, Ernest Andrew, 71, East-hill, Wandsworth, S.W.
1903			Atkinson, Edwin Bayles, Furze Glen, Lambert-road, Grimsby
1903			Atkinson, Harford Montgomery, B.Sc. (Wales), Ph.D. (Göttingen), 69, George-street, Limerick, Ireland
1911			Atkinson, Norman Ernest, Ash Cottage, Thornhill Lees, Dewsbury
1872	Trans.		‖Atkinson, Robert William, B.Sc. (Lond.), F.I.C., 44, Stuart-street, Cardiff
1903	Trans.		Attwell, Herbert Moore, A.R.C.S., St. Margaret's-hill, Bradford-on-Avon
1872	Trans.		‖Attwood, George, M.Inst.C.E., Steyning Manor, Stogursey, Somerset; and 56, Moorgate-street, E.C.
1908			Aubertin, Thomas, B.A. (Oxon.), 20, Tennyson-mansions, Queen's Club-gardens, Kensington, W.
1903			Aubrey, Henry James, The Cross, Worcester
1910			Auchinlech, Gilbert Grahame, B.Sc. (McGill), Agricultural Dept., Grenada, British West Indies
1895	Trans.		‖Auden, Harold Allden, 13, Broughton-drive, Grassendale, Liverpool
1886			‖Audley, James Aloysius, B.Sc. (Lond.), A.R.C.S., F.I.C., 17, Gladstone-place, Hanley
1911	Trans.		Auld, Samuel James Manson, D.Sc. (Lond.), Ph.D. (Würzburg), F.I.C., South Eastern Agricultural College, Wye, Ashford
1906	Trans.		‖Austin, Percy Corlett, M.A. (Cantab.), University College, Reading

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892			Avery, David, M.Sc. (Melbourne), 461, Barkers-road, Kew, Melbourne, Australia
896			Aykroyd, Henry Edward, Woodbank, Harden, Bingley
908			Ba, Maung, B.A. (Calcutta), Rangoon College, Rangoon, Burma
903			‖Badcock, William Cornish, M.A. (Cantab.), Northampton and County School, Northampton
907	Trans.		Bagley, George, c/o Young's Chemical Works, 41B, Kent-terrace, Wellington, New Zealand
904			Baguley, Allan, B.Sc. (Wales), F.I.C., Harris Institute, Preston
907			Bailey, Francis James, Findon Hill, Sacriston, Durham
875	Trans.		‖Bailey, George Herbert, Ph.D. (Heidelberg), D.Sc. (Lond.), The University, Manchester; and Edenmor, Kinlochleven, Argyll, N.B.
893			Bailey, Henry, 14, Selborne-road, Ilford
900	Trans.		Bain, Alexander William, B.A. and B.Sc. (Lond.), F.I.C., Fairlight, Muswell-rise, Muswell Hill, N.
884			‖Bain, Daniel, United Alkali Co., Ltd., Allhusen's Works, Gateshead-on-Tyne
891			Bairstow, John, Burley, Queen's-park, Chester
901			Baker, Arthur, 2, Carlton-avenue, Horn's Cross, Greenhithe, Kent
889			‖Baker, Charles Frederic, B.Sc. (Lond.), Ph.D. (Strassburg), Technical College, and 29, Roker-park-road, Sunderland
883	Trans.		‖Baker, Charles John, The Schools, Shrewsbury
899			Baker, Clement Harrison, c/o Messrs. C. Harrold & Co., 2 and 3, St. Paul's-square, Birmingham
907	Trans.		Baker, Frank, B.Sc. (Lond.), A.I.C., c/o Nobel's Explosives Co., Ltd., Stevenston, Ayrshire
902			Baker, Frederick Guy Stirling, M.A. (Oxon.), A.I.C., Marryatt's Lodge, Snaresbrook, Essex
881	Trans.		Baker, Harry, F.I.C., Epworth House, Moughland-lane, Runcorn
884	Trans.	C. 1899-03	‖Baker, Herbert Brereton, M.A. and D.Sc. (Oxon.), F.R.S., Christ Church, Oxford
893	Trans.	C. 1908-11	Baker, Julian Levett, F.I.C., Stainesbury Holt, Kingston-road, Staines
908	Proc.		Baker, Thomas James, D.Sc. (Lond.), B.Sc. (Birm.), St. Margaret's Lodge, Chester-road, Erdington, Birmingham
901			Baker, Thomas Thorne, 15, Grosvenor-gardens, Cricklewood, N.W.
908			Baker, William Henry Benson, B.A. (Oxon.), Frognal Dene, Hampstead, N.W.
873			Baldock, John Henry, Overdale, St. Leonard's-road, Croydon
01	Trans.		Ball, Walter Craven, M.A. (Oxon.), Warren Cottage, Hayes, Kent; and Guy's Hospital, S.E.

Date of Election.			
1907			Ball, William Robert, B.Sc. (Lond.), 48, Cambridge-road, Thornaby-on-Tees
1892			‖Ballantyne, Horatio, F.I.C., 75, Chancery-lane, W.C.
1908			Ballantyne, William Henry, B.Sc. (Glas.), 17, Westwell-road, Streatham Common, S.W.
1896			Ballingall, William, M.A. (St. Andrews), 9, Dudhope-terrace, Dundee
1891	Trans.	C. 1905-08	Baly, Edward Charles Cyril, Prof., F.R.S., F.I.C., The University and 14, Sunnyside, Prince's-park, Liverpool
1886			Bamber, Henry Kelway George, Ingress House, Greenhithe, Kent
1890	Proc.		Bamber, Montague Kelway, F.I.C., The Laboratory, Hyde-park-corner, Colombo, Ceylon
1896			Banerjee, Gopal Chandra, Kaiser Soap Co., Cawnpore, India
1910			Banerjee, Manindra Nath, 3, Padmanath-lane, Shambazar, Calcutta, India
1910			Banister, Fred., B.Sc. (Wales), Dene Lodge, London-road Guildford
1907			Banks, Arthur John, c/o The Ogilvie Flour Mills Co., Ltd. Montreal, Canada
1911			Barbary, John Ewart Trounce, Vellansaundry, Camborne
1904	Trans.		Barbour, William, M.A. and B.Sc. (St. Andrews), F.I.C., Dalswinton, 26, All Saints'-road, Peterborough
1905			Barbrook, George Henry, c/o Messrs. T. Prentice & Co., Stowmarket, Suffolk
1880			‖Barclay, Arthur Edward, 95, Farringdon-street, E.C.
1903	Trans.		‖Barger, George, M.A. (Cantab.), D.Sc. (Lond.), The Goldsmiths' College, New Cross, S.E.
1906			Barker, Arthur Ernest, B.A. and B.Sc. (Lond.), Royal Grammar School, Colchester
1909			Barker, Donald William Elsom, 2, Hope-street, Wrexham
1890			‖Barker, Joseph, Rev., M.A. and D.D. (Oxon.), Newton House, Newton, near Nottingham
1903	Trans.		Barker, Thomas Vipond, M.A. and B.Sc. (Oxon.), Mineralogical Dept., University Museum, Oxford
1896			Barker, William Henry, B.Sc. (Lond.), Addiscombe, Empress-avenue, Wanstead Park, Essex
1894			Barlet, Stéphane, B. ès Sc. (Gall.), 97, St. Mark's-road, North Kensington, W.
1897			Barlow, Herbert William Leyland, M.A. and M.D. (Oxon.), M.R.C.S. and L.R.C.P. (Lond.), D.P.H., (Cantab.), Holly Bank, Croftsbank-road, Urmston, Manchester
1897	Trans.		Barlow, William, F.R.S., The Red House, Stanmore, Middlesex
1891			Barnes, Edward Arthur, 194, Hammersmith-road, W.

Date of Election.			
1905			Barnes, James Hector, Prof., B.Sc. (Birm.), F.I.C., Government College of Agriculture, Lyallpur, Punjab, India
1875			‖Barnes, Richard Leburn, Phœnix Chemical Works, Hackney Wick, N.E.
1907	Trans.		Barnett, Edward de Barry, B.Sc. (Lond.), A.I.C., 9, Collingham-road, South Kensington, S.W.
1909	Trans.		Baron, Harold, B.Sc. (Vict.), 5, Quality-court, Chancery-lane, W.C.
1908			Barr, Guy, B.A. (Cantab.), B.Sc. (Lond.), Pyrmont, Clarence-road, Teddington, Middlesex
1888			‖Barraclough, William Herbert, F.I.C., Mortomley, near Sheffield
1891			Barratt, John Treeby, 21, Godolphin-road, Helston
1869			Barret, Edward Louis, B.Sc. (Lond.), F.I.C., 12, Avenue de la Grande Armée, Paris
1906	Trans.		Barrett, Ernest, B.Sc. (Lond.), 27, Merchiston-road, Catford, S.E.
1908			Barrett, Maurice, Cliff Lawn, Hyde-park, Leeds
1901			Barrie, Thomas Stewart, 4, Newton-street, Charing-cross, Glasgow
1905			Barrowcliff, Marmaduke, F.I.C., The Institute of Medical Research, Kuala Lumpur, Federated Malay States
1872			‖Barton, Robert, Royal Mint, Melbourne, Australia
1908			Barton, Robert, jun., 1, Fairfield-avenue, Fairfield, Droylsden, Manchester
1910			Barwick, Fred Wilkinson, Chamber of Commerce Testing House, Royal Exchange, Manchester
1898			Baskerville, Charles, B.Sc. (Virginia), Ph.D. (N. Carolina), College of the City of New York, New York City, U.S.A.
1864	Trans.	C. 1870-3, 90-3	‖Bassett, Henry, F.I.C., 26, Belitha-villas, Barnsbury, N.
1907	Trans.		Bassett, Henry, jun., D.Sc. (Lond.), Ph.D. (Munich), D. ès S., (Nancy), F.I.C., The University, Liverpool
1911			Bate, Joseph, 59, Southwood-lane, Highgate, N.
1891			Bate, William, Upton Villa, Hayle, Cornwall
1893			Bateman, John, Clovelly, 14, Stirling-road, Clapham Rise, S.W.
1896			Bathurst, Charles, B.A. (Oxon.), M.P., Lydney-park, Lydney, Glos.
910			Batley, Ward Allen, M.Sc. (Manc.), 197, Eccles New-road, Salford, Manchester
910			Baume, Georges, 44, Quai des Eaux Vives, Geneva, Switzerland
905			Baxter, John George, River View, Burch-road, Rosherville
892			Bayliss, Charles, Mino, Hampton-in-Arden, Birmingham
906			Bayliss, William Heath, Brewery House, Ashwell, Herts.
874			‖Bayne, James, (unknown)
879			‖Bayne, William Thirlwall, LL.D. (Cantab.), Brockhill, Broadclyst, Exeter

Date of Election			
1897			Beadle, Alec Alfred, Donnington Dene, Newbury
1891	Trans.		Beadle, Clayton, Oak Bank, Lansdown-road, Sidcup, Kent
1861			‖Beadnell, Charles Edward, Major, R.A., Hafod, Llandinam, Mont.
1903			Beadnell, Charles Marsh, M.R.C.S. (Eng.), L.R.C.P. (Lond.), Fleet Surgeon, H.M.S. Fisguard, Portsmouth
1867			Beale, William Phipson, K.C., M.P., 10, New-court, Carey-street, Lincoln's Inn, W.C. ; and 2, Whitehall-court, S.W.
1903			Beam, William, M.A. and M.D. (Penn.), F.I.C., Chemical Laboratory, Gordon College, Khartoum, Soudan
1899			Bean, Percy, 10, Marsden-street, Manchester
1902			Beanes, Alfred Edward, Falcon Works, Wallis-road, Hackney Wick, N.E.
1890			Beardmore, George Russell, L.R.C.P. (Lond.), M.R.C.S. (Eng.), L.S.A., D.P.H. (Cantab.), Warwick House, Upper-street, Islington, N.
1901			Beaven, Edwin Sloper, Eastway, Warminster
1890	Trans.		Beck, Charles Ridgeway, F.I.C., 53, Norroy-road, Putney, S.W.
1874	Trans.		‖Beckett, George Henry, F.I.C., 35, South Beach-road, Ardrossan, N.B.
1906			Beckett, Richard Henry, Prof., B.Sc. (Lond.), The Victoria College of Science, Nagpur, C.P., India
1901			Bedford, Frederick, B.Sc. (Lond.), Ph.D. (Halle), 9, Market-place, Sleaford, Lincs.
1879	Trans.	C. 1895-	Bedson, Peter Phillips, Prof., M.A. (Dun.), D.Sc. (Lond. and Dun.), B.Sc. (Vict.), F.I.C., Armstrong College of Science, Newcastle-on-Tyne
1901			Bedwell, John Cardew, B.Sc. (Lond.), 65, High-street, Colchester
1905			Bees, William James, B.Sc. (Lond.), 43, Ash-grove, Hyde-park, Leeds
1899			Beesley, Frederick Arnold, B.Sc. (Lond.), 7, Whitmore-road, Beckenham, Kent
1872	Trans.	C. 1907-11 V.-P. 1911-	‖Beilby, George Thomas, Hon. LL.D. (Glas.), F.R.S., F.I.C., 11, University-gardens, Glasgow
1891			Belbin, Tom St. John, Capt., Nortonthorpe Hall, near Huddersfield
1891			‖Bell, Albert Edward, F.I.C., 59, Trinity-square, Southwark, S.E.
1886	Trans.		Bell, Chichester Alexander, B.A. and M.B. (Dub.), F.I.C., Torbrex, Headington-hill, Oxford
1889			Bell, Edward Wightman, The Chantry, Spalding
1898			Bell, Hugh Poynter, M.A. (Cantab.), 17, Tothill-street, Westminster, S.W.
1865	Trans.		‖Bell, J. Carter, A.R.S.M., F.I.C., The Cliff, Higher Broughton, Manchester

Date of Election		
1907		Bell, John Forbes, Craigmillar, Edinburgh
1889		‖Bell, Percy Carter, F.I.C., Milburn, New Jersey, U.S.A.
1906		Bell, William Edward, c/o Messrs. Tomlinson and Hayward, Manufacturing Chemists, Lincoln
1904	Trans.	Bellars, Albert Ernest, Prof., M.A. (Cantab.), The Government College, Rangoon, Burma
1905		Belton, Francis George, B.A. (Dun.), 336, Belgrave-road, Birmingham
1879		Bemrose, Joseph, F.I.C., 56, St. Famille-street, Montreal, Canada
1874		‖Bendix, David, F.I.C., Sutherland Lodge, 371, Romford-road, Forest Gate, E.
1902	Proc.	Bengough, Guy Dunstan, M.A. (Cantab.), The University, and 25, Huskisson-street, Liverpool
1902		Benham, Keith Benham, B.Sc. (Lond.), F.I.C., Dean's Hill, Stafford
1881		‖Benjamin, Marcus, A.M. (Lafayette), Ph.B. (Columbia), Ph.D. (Nashville), Sc.D. (Pittsburg), LL.D. (Annapolis), U.S. National Museum, Washington, D.C., U.S.A.
1900	Trans.	Bennett, Alexander Hutcheon, c/o Messrs. G. H. Ogston & Moore, Catania, Sicily
1904		Bennett, Charles Thomas, B.Sc. (Lond.), F.I.C., 102, Queen's-road, Wimbledon, S.W.
1903		Bennett, Colin Noël, Escot, Penzance, Cornwall
1909	Trans.	Bennett, Hugh Garner, M.Sc. (Leeds), 5, St. Nicholas-road, Beverley
1905		Bennett, Joseph, Windsor Printing Co., North Adams, Mass., U.S.A.
1911		Bennison, Ernest Carr, 4, Sir John's-road, Selly-park, Birmingham
1892	Trans.	Bensusan, Arthur John, The Ouro Preto Gold Mines of Brazil, Ltd., Minas de Passagem Ouro Preto, Brazil
1896	Trans.	Bentley, William Henry, B.Sc. (Vict.), 12, Cromwell-terrace, Irlam, near Manchester
1907		Benton, Frank Stanley, Hursthead, Reigate, Surrey
1890		Bentz, Ernest, 107, Shaw-lane, Dinting, near Manchester
1910		Berens, Herbert Arthur, Sidney Sussex College, Cambridge
1902	Trans.	Bergtheil, Cyril, Research Station, Sirseah, Mozufferpore Post Office, T. S. Railway, India
1882		‖Beringer, John Jacob, A.R.S.M., F.I.C., Basset-road, Camborne, Cornwall
1895	Trans.	Berkeley, The Rt. Hon. Randal Thomas Mowbray, The Earl of, F.R.S., Foxcombe, Boar's Hill, Oxford
1890		‖Berncastle, Richard, 15, Ladbroke-gardens, Notting Hill Gate, W.
1893		Berridge, Douglas Jesse Penfold, M.A. (Oxon.), The Laboratory, Malvern College

Date of Election			
1906	Trans.		‖Berry, Arthur John, B.A. (Cantab.), Downing College, Cambridge
1882			‖Berry, Edward Elhanan, 44, London Wall, E.C.; and Vice-Consulate, Bordighera, Italy
1898			Berry, Reginald Arthur, Prof., F.I.C., The West of Scotland Agricultural College, 6, Blythswood-square, Glasgow
1891			Berry, Thomas William, Education Office, Pentre, Rhondda, Glam.
1888	Proc.		Berry, William, 7, Hampton-park, Redland, Bristol
1909	Trans.		Best, Stanley Robert, M.Sc. (Manc.), Woodlea, Wellington-road, Whalley Range, Manchester
1906			Bethea, Oscar Walter, Prof., M.D. (Miss.), Ph.G. (Atlanta), Mississippi Medical College, 8306, Panola-street, New Orleans, La., U.S.A.
1910			Bethwaite, John, 48, Northumberland-street, Workington
1883	Trans.	{C. 1898-1900}	‖Bevan, Edward John, F.I.C., 3, New-court, Carey-street, W.C.
1886			Bevan, John Williams, F.I.C., Risedale, St. James-crescent, Swansea; and c/o Morriston Spelter Works, Morriston, Glam.
1903			Beveridge, Wilfred William Ogilvy, Major, R.A.M.C., D.S.O., M.B. (Edin.), D.P.H. (Cantab.), 11, Halsey-street, Cadogan-gardens, S.W.
1897			Bhaduri, Jyoti Bhushan, M.A. (Calcutta), Krishnaghur College, Krishnaghur, Dist. Nadia, Bengal, India
1903			Bhaduri, Kula Bhushan, Prof., M.A. (Calcutta), Canning College, Lucknow, India
1910			Bhattacharya, Sarat Chandra, Prof., M.A. (Calcutta), St. Columba's College, Hazaribagh, Bengal, India
1903			Bibby, Charles Drake, Heath-row, Strafford-road, Twickenham
1903			Bibby, Robert Gordon, 5, Halfmoon-street, W.
1865			‖Bickerdike, William Edward, F.I.C., Bryers Croft, Wilpshire, near Blackburn
1908			Bickerstaffe, Robert, Chilterns, Wooburn-green, Bucks.
1901			‖Bickford, Harding, 46, Currie-street, Adelaide, South Australia
1875			Biggart, John William, F.I.C., Chemical Laboratory, 29, Cathcart-street, Greenock
1881			Bingley, John, Northampton
1900			Binks, Frederick Nisbet, 29, Beech-grove, Whitley Bay, Northumberland
1908			Birch, William Colet, B.A. (Cantab), A.I.C., 22, Glazbury-road, West Kensington, W.
1894			Bird, William Rowland, Chem. Lab., G.W.R. Works, Swindon
1906			Birt, Roderick Harold Capper, Rev., B.A. (Oxon.), St. Peter's College, Radley, Abingdon
1879			‖Black, Andrew Heggie, Moor Lodge, Harrogate
1904			Black, John Wyclif, 67, Falcon-road, Edinburgh

Date of Election		
1909		Blackburn, Albert Riley, B.Sc. (Lond.), A.R.C.S., Marshville, Derby-road, Widnes
1911		Blackburn, Joseph Mayson, 346, Deane Church-lane, Bolton.
1899	Trans.	Blackman, Walter Lionel, Mostyn, Stanthorpe-road, Streatham, S.W.
1903		Blackshaw, George Neville, B.Sc. (Wales), Analytical Laboratory, Dept. of Agriculture, Salisbury, Rhodesia, S. Africa
1899		Blackshaw, John Frank, The Cottage, Bromsgrove
1902		Blair, Herbert, 23, Ashley-road, West Harton, South Shields
1901		Blake, George Stanford, 15, Vernon-street, Broughton, Manchester
1890	Trans.	Blake, Robert Frederick, F.I.C., Chemical Department, Queen's College, Belfast
1890		Blake, William Henry, 12, Lombard-street, Newcastle-on-Tyne
1875		‖Blanshard, Charles Thomas, M.A. (Oxon.), Lowton, Newton-le-Willows
1906		Blatchley, Charles Frederick Polwhele, B.A. (Oxon.), 13, Templars-avenue, Golders Green, N.W.
1892		Bleckly, Arthur Sanderson, Marldon, Thelwall, Warrington
1902		Blenkinsop, Richard, c/o Messrs. May & Baker, Ltd., Garden Wharf, Church-road, Battersea, S.W.
1890		Blenkinsop, William Edmund Brandford, c/o Messrs. May and Baker, Ltd., Garden Wharf, Church-road, Battersea, S.W.
1909		Bletcher, Henry Ernest John, Prof., College of Pharmacy, Winnipeg, Manitoba, Canada
1903		Bliss, Henry James Wheeler, M.A. (Oxon.), 50, City-road, E.C.
1899		Blofeld, Stuart, Rev., B.A. and B.Sc. (Lond.), Saltley Training College, Birmingham.
1896		‖Blood, Maurice, M.A. (Oxon.), 8, Chichele-road, Cricklewood, N.W.
1891		Bloomer, Frederick John, F.I.C., Penpont, Clydach, Glamorgan
1890	Trans.	Blount, Bertram, F.I.C., 76 and 78, York-street, Westminster, S.W.
1888		Bloxam, Arthur George, F.I.C., 105, Birkbeck Bank-chambers, Southampton-buildings, W.C.
1883	Trans.	‖Bloxam, William Popplewell, Prof., B.Sc. (Lond.), F.I.C., Sulphate of Ammonia Committee, 4, Fenchurch-avenue, E.C.; and 15, Crescent-mansions, Elgin-crescent, Holland Park, W.
1903		Bluman, Nicholas John, Primrose Club, 4, Park-place, St. James, S.W.
1887		Blundstone, Edwin Richardson, B.A. (Cantab.), Heathfield, Hampton Hill, Middlesex
1865	Trans.	Blunt, Thomas Porter, M.A. (Oxon.), F.I.C., Tower-place, Shrewsbury
1896		Blyde, Joseph Edwin Alger, East Cliffe, East Bank-road, Sheffield

Date of Election.			
1875	Trans.		Blyth, Alexander Wynter, M.R.C.S. (Eng.), L.S.A. (Lond.), F.I.C., 26, Avenue-road, Regent's Park, N.W.
1892			Blyth, Meredith Wynter, B.A. (Cantab.), B.Sc. (Lond.), F.I.C., The Lodge, Ardsley, Barnsley
1908	Trans.		Blyther, Donald Francis, B.Sc. (Lond.), A.R.C.S., 77, Knights-road, Silvertown, E.
1875			‖Boake, Arthur, Chemical Works, Stratford, E.; and Highstanding, Loughton, Essex
1902			Boardman, Ernest, B.Sc. (Vict.), 619, St. Helens-road, Bolton
1878			Bodmer, Richard, F.I.C., Analytical Laboratory, 16, Southwark-street, S.E.
1898			Bogert, Marston Taylor, Prof., B.A. and Ph.B. (Columbia), Hon. LL.D. (Clark), Columbia University, New York City, U.S.A.
1906			Bogue, Thomas Going Stoney, 5, Kenilworth-square, Dublin
1869	Trans.		‖Bolas, Thomas, F.I.C., 60, Grove-park-terrace, Chiswick, W.
1901			Bolton, Edward Richards, 16, Flanchford-road, Ravenscourt Park, W.
1899			‖Bond, Alfred Ernest, 13, Hermitage-road, Edgbaston, Birmingham
1883			Bond, Henry Charles, Rev., M.A. (Oxon.), Belle Vue Hall, Brighton
1893	Trans.	C. 1909-	‖Bone, William Arthur, Prof., D.Sc. (Vict.), Ph.D. (Heidelberg), F.R.S., West House, 18, Lidgett-park-road, Roundhay, Leeds
1893			Boone, William Thomas, B.A. and B.Sc. (Lond.), 6, Sydenham-villas, Cheltenham
1884			Borland, William Dalrymple, F.I.C., Beacon Lodge, Green Street Green, near Dartford, Kent
1881			‖Borns, Henry, Ph.D. (Greifswald), 5, Sutton Court-road, Chiswick, W.
1895			‖Borradaile, Lancelot Alexander, M.A. (Cantab.), Selwyn College, Cambridge
1861			‖Bosanquet, Robert Holford Macdowall, M.A. (Oxon.), F.R.S., Castillo Zamora, Realijo Alto, Teneriffe, Canary Islands
1894	Proc.		Bose, Chuni Lal, Prof., 25, Mohendra Bose's-lane, Calcutta
1881			Bostock, George Henry, 151, Medland-street, West Toronto, Canada
1910			Bosworth, Stewart McGregor, B.Sc. (Lond.), 37, Scarsdale-villas, Kensington, W.
1881	Trans.		Bothamley, Charles Herbert, M.Sc. (Leeds), F.I.C., Tangle Wood, Southside, Weston-super-Mare
1887	Trans.		Bott, William Norman, Ph.D. (Heidelberg), 16, St. Helens-place, E.C.
1909			Bottomley, Hubert Frederick, Haslemere, Eastwood-road, South Woodford, N.E.

Date of Election.			
1869			‖Bottomley, James Thomson, B.A. (Dub.), M.A. and D.Sc. (R.U.I.), Hon. LL.D. (Glas.), F.R.S., 13, University-gardens, Glasgow
1886			Bottomley, William Beecroft, Prof., M.A. (Cantab.), Ph.D., 35, Downside-crescent, Hampstead, N.W.
1894			Boul, William Good, M.A. and LL.D. (Dub.), D.C.L. (Dun.), Tideswell Grammar School, near Buxton
1910			Bourdillon, Robert Benedict, Buddington, Midhurst
1905	Trans.	C. 1911-	Bousfield, William Robert, M.A. (Cantab.), K.C., St. Swithin's, Hendon
1891			Bovell, John Redman, Dodd's Botanical and Experimental Station, Barbados, West Indies
1911	Trans.		Bowden, Richard Charles, B.Sc. (Bristol), 21, Rokeby-avenue, Redland, Bristol
1865			‖Bowdler, Arthur Clegg, F.I.C., 20, Bank-terrace, Wellington-street, Blackburn
1888			Bower, Frank, c/o Messrs. Truman, Hanbury and Buxton, Spitalfields, E.
1894			Bowes, Harry, F.I.C., Messrs. Bowes and Sims, 40, Radford-street, Blackley, Manchester
1906			Bowis, William John, Ph.D. (Zürich), 25, Rectory-road, West Bridgford, Nottingham
1899			Bowles, Bertram Hennessey, Overdale, Eastwood-road, South Woodford, N.E.
1896			Bowley, Joseph John, Wellington Works, Battersea Bridge, S.W.
1896			‖Bowman, Herbert Lister, Prof., M.A. and D.Sc. (Oxon.), Magdalen College, Oxford
1911			Bowyer, Arthur Stewart, M.Sc. (Manc.), The Woodlands, Chelford, Cheshire
1894	Trans.		Boyd, David Runciman, Prof., D.Sc. (Glas.), Ph.D. (Heidelberg), F.I.C., The Hartley University College, Southampton
1901			Boyers, Henry, 20, Knox's-street, Sligo
1869			‖Braby, Frederic, Bushey Lodge, Teddington
1910			Bracewell, Geoffrey Alfred, 20, Heaton-grove, Bradford
1910			Bracher, André, 30, Guilford-street, W.C.
1903			Bradbury, Samuel, Ferncliff, Milton-grove, Glebelands-road, Ashton-on-Mersey, Cheshire
1895			Bradford, Henry, Strettington, near Chichester
1876			‖Bradley, Nathaniel, Sunnyside, College-road, Whalley Range, Manchester
1888			Bradshaw, Charles, 169, Spring Vale-road, Sheffield
1910			Brady, Frederick Hugh Rochfort, 12, Park-view-avenue, Harold's-cross, Dublin

Date of Election.		
1910	Trans.	Brady, Oscar Lisle, B.A. (Cape of Good Hope), A.I.C., 51, Upper Bedford-place, W.C.
1906		Braid, Arthur Forbes, c/o The New Jersey Steel Co., Rahway, N.J., U.S.A.
1908		Brakes, William Sudderick, 119, Steade-road, Sheffield
1894	Trans.	Brame, John Samuel Strafford, Royal Naval College, Greenwich, S.E.
1903		Branch, George Thomas, P.O. Box 51, Umtali, Rhodesia, S. Africa
1882		Branson, Frederick Woodward, F.I.C., 14, Commercial-street, Leeds; and Wynneholme, Far Headingley, Leeds
1908		Braun, Marie Joseph Arsène, Ph.D. (Bâle), 5, Aspinall-road, Brockley, S.E.
1882	Trans.	Brauner, Bohuslav, Prof., Ph.D. (Prague), Hon. D.Sc. (Manc.), New Chemical Laboratory, Bohemian University, Prague, VI., Bohemia
1896		Bray, Daniel, 63, Morehampton-road, Donnybrook, Dublin
1909		Breakspear, Henry Shaw, B.A. (Oxon.), The Grammar School, Ludlow
1905		‖Brettell-Vaughan, Edward Shipley Hewitt Edwards, Cwm Cottage, The Cwm, Aston-on-Clun, Salop.
1883		Briant, Lawrence, 24, Holborn-viaduct, E.C.
1901		Bridges, Joseph Samuel, B.Sc. (Lond.), 45, Thistlethwaite-road, Clapton, N.E.
1904	Trans.	Bridgett, Robert Currie, M.A. and B.Sc. (St. Andrews), Dunlossit, Dryburgh-avenue, Rutherglen, Glasgow
1897		Brierley, James, 33 and 35, French-street, Southampton
1890	Trans.	Brierley, John Thomas, Highfield, Golden Hill, Leyland, near Preston
1898		Brierley, Joseph, B.Sc. (Vict.), Ashton-road, Failsworth, Manchester
1910		Briggs, John C., Camden House, Cavendish-road, Leicester
1893	Trans.	Briggs, John Frederick, Auchmuty Paper Mills, Markinch, Fife, N.B.
1906		Briggs, Richard Victor, c/o Dr. C. Schulten, P.O. Box 279, 4, Pollock-street, Calcutta, India
1905	Trans.	Briggs, Samuel Henry Clifford, D.Sc. (Vict.), Greenbank, Cleckheaton, Yorks.
1883		‖Briggs, Thomas Lynton, F.I.C., 188, Central-avenue, Flushing, L.I., U.S.A.
1884		‖Briggs, William, LL.D., D.C.L., M.A., B.Sc., Burlington House, Cambridge
1902		Brincker, John Augustus Herman, B.A., M.B., B.C. and D.P.H. (Cantab.), B.A. (Cape of Good Hope), M.R.C.S. (Eng.), L.R.C.P. (Lond.), F.I.C., Colinton, Teignmouth-road, Cricklewood, N.W.

Date of Election.			
1910			Briscoe, Henry Vincent Aird, B.Sc. (Lond.), A.R.C.S., 33, Bargery-road, Catford, S.E.
1889			Broadbent, Harry, F.I.C., 183, Hyde Park-road, Leeds
1879			‖Broadbent, John James, F.I.C., Waikino, Ohinemari, Auckland, New Zealand
1883			Brock, John, J.P., F.I.C., Gwern-Tyno, Colwyn Bay, N. Wales
1893			‖Brockbank, John Edwin, The Croft, Kirksanton, viâ Carnforth
1898			Brooke, Arthur, M.A. (Cantab.), The Grammar School, Caistor, Lincs.
1900			Brooke, Charles Berjen, Colne House, Brantham, near Manningtree, Essex
1900			Brooke, John Richard, J.P., F.I.C., Government Opium Factory, Singapore, Straits Settlements
1906			Broome, James Spears, M.Sc. (Manc.), 18, Seedley-park-road, Pendleton, Manchester
1886	Trans.		‖Brothers, Horace Edward, B.Sc. (Lond.), F.I.C., Clooney-park, Londonderry
1876	Trans.	C. 1910-	Brown, Adrian John, Prof., M.Sc. (Birm.), F.R.S., F.I.C., West Heath House, Northfield, Birmingham
1867	Trans.	C.1872-4, V.P.81-4, 90-1. P. 91-3	Brown, Alexander Crum, Prof., M.A., M.D., and F.R.C.P. (Edin.), D.Sc. (Lond.), LL.D. (Aberd. and Glas.), F.R.S., F.I.C., Hon. LL.D. (St. Andrews), 8, Belgrave-crescent, Edinburgh
1870			Brown, David, F.I.C., 93, Abbey-hill, Edinburgh
1891			Brown, Edward Hilton, c/o Messrs. W. Ropes and Co., St. Petersburg, Russia
1873	Trans.	C. 1881-3	‖Brown, Frederic Douglas, Prof., B.Sc. (Lond.), University College, Auckland, New Zealand
1884			Brown, Frederic William, Ingleside, 39, Loveday-road, West Ealing, W.
1892			Brown, George Fitz-, A.R.S.M., F.I.C., The Broughton Copper Co., Ditton Copper Works, Widnes
1897			Brown, Gerald Noël, 20, Cullum-street, E.C.
1880			Brown, Henry, F.I.C., Benskin's Brewery, Watford, Herts.
1871	Trans.	C. 1883-7, V. P.94-7, 1904-7 T.1903-04 F.S.1907-	†Brown, Horace Tabberer, LL.D. (Edin.), F.R.S., F.I.C., 52, Nevern-square, Kensington, S.W.
1908			Brown, James, 20, Tower-road, Dartford, Kent
1905			Brown, John Coggin, B.Sc. (Dun.), Geological Survey of India, Calcutta, India
1882			Brown, Reginald Busby, c/o The Badische Co., Ltd., 2, Samuel Ogden-street, Manchester
1908			Brown, Walter, jun., Victoria-street, Newton Stewart, N.B.

† Longstaff Medallist, 1894.

Date of Election.		
1884		Brown, William George, Prof., Ph.D. (N. Carolina), B.S. (Virginia), University of Missouri, Columbia, Missouri, U.S.A.
1896		Browne, Charles Edward, B.Sc. (Lond.), Christ's Hospital, West Horsham, Sussex
1893		Browne, Frank, F.I.C., Hill Crest, Cemetery-road, Bury St. Edmunds
1873		Brownen, George, Grove-road-east, Avon-park, Christchurch
1899	Trans.	Browning, Kendall Colin, Prof., M.A. (Cantab.), Medical College, Colombo, Ceylon
1890		Brownsword, Frank, M.Sc. (Vict.), F.I.C., Bryn Derwen, Old Colwyn, N. Wales
1902		Bruce, Alexander, B.Sc. (Edin.), The Laboratory, Hyde-park-corner, Colombo, Ceylon
1894	Trans.	Bruce, James, B.Sc. (Lond.), Ph.D. (Munich), A.R.C.S., F.I.C., The Technical College, Huddersfield
1901		‖Bruce-Kingsmill, Julian, Major, R.A., M.A. and B.Sc. (Glas.), 196, Deansgate, Manchester
1903		Brühl, Paul, Civil Engineering College, Sibpur, near Calcutta, India
1898	Trans.	‖Brünnich, Johannes Christian, F.I.C., Department of Agriculture, Brisbane, Queensland
1909		Brunskill, Hubert, 71, West End-road, Southall
1893	Trans.	‖Brunton, John Dixon, c/o Prof. O. W. Richardson, Princeton, N.J., U.S.A.
1902		Bryant, Vernon Seymour, B.A. (Cantab.), Trelawne, Crowthorne, Berks.
1877	Trans.	Buchanan, John Young, M.A. (Cantab.), F.R.S., F.I.C., 26, Norfolk-street, Park-lane, W.
1910		Buchner, Eduard, Prof., Ph.D. (Munich), Pleicher Ring 11, Würzburg, Germany
1876		‖Buckmaster, Charles Alexander, M.A. (Oxon.), 16, Heathfield-road, Mill Hill Park, Acton, W.
1902		Bucknell, Edwin Thomas Holman, Kingsholme School, Weston-super-Mare
1907	Trans.	Buckney, Frank, B.A. (Cantab.), Custom House, Madras, India
1903		Buggé, Erasmus Robert, 13, Prince's-avenue, Church End, Finchley, N.
1901		Bult, Herbert John, 18, Billiter-street, E.C.
1890		Bunting, Henry Herbert, Oficina de Ensayes F. C. C. del Peru, Callao, Peru
1896		Burbridge, James Kerry, F.I.C., The Orchard, Philip-lane, Tottenham, N.
1911		Burbridge, Walter Norman, Uplands, Foxley-lane, Purley, Surrey

Date of Election.		
1891		Burford, Samuel Francis, The Ridgeway, Rothley, Loughborough, Leicester
1910	Proc.	Burger, Oskar Krafft Heinrich, Prof., Ph.D. (Munich), Civil, Engineering College, Sibpur, Calcutta, India
1894	Trans.	Burgess, Herbert Edward, Holly House, Graham-road, N.E.
1901		Burgess, Percival James, M.A. (Cantab.), 8, Gunnersbury-avenue, Ealing Common, W.
1884		Burgess, William Thomas, F.I.C., 20, Priory-road, Bedford Park, W.
1903		Burghard, William Godsell, 43, New Oxford-street, W.C.
1884		‖Burland, Jeffrey Hale, Colonel, c/o Fraser Library, Montreal Canada
1897		Burland, Richard Oxley, J.P., Poolstock House, Wigan
1901		‖Burnett, Theodore Ridley, B.Sc. (Vict.), Ph.D. (Bâle), The George Green Schools, East India Dock-road, Poplar, E.
1893		Burnham, John Charles, B.Sc. (Vict.), F.I.C., Cordite Factory, Aruvankadu, Wellington, Nilgiri Hills, India
1882	Trans.	Burrell, Benjamin Arthur, F.I.C., 8, Springfield Mount, Leeds
1902	Trans.	Burrows, Harry, Ph.D. (Heidelberg), A.R.C.S., F.I.C., The Green, Southgate, N.
1901	Trans.	Burrows, Merrick William, M.Sc. (Vict.), Dunkirk, Devizes
1905	Trans.	Burt, Bryce Chudleigh, B.Sc. (Lond.), Department of Agriculture, Cawnpore, India
1909	Trans.	Burt, Frank Playfair, B.Sc. (Lond.), Elmhyrst, Weston-super-Mare
1891		Burton, William, Clifton Junction, near Manchester
1903		Bury, Ernest, M.Sc. (Vict.), Queensmede, Saltburn-by-the-Sea
1909		Bury, Frank Ward, B.Sc. (Manc.), 14, Osbourne-street, Hebden Bridge
1894		Bush, William, School of Science and Art, Free Library, Newport, Mon.
1910		Buswell, Henry Leslie Farmer, B.A. (Cantab.), 169, Queen's-gate, S.W.
1890		Butcher, William James, B.Sc. (Lond.), Queen Elizabeth Grammar School, Ashbourne, Derbyshire
1895		Butler, David Butler, 41, Old Queen-street, Westminster, S.W.
1890		Butler, William Waters, Southfield, Norfolk-road, Edgbaston, Birmingham
1894		Buttemer, Robert William, St. Mary's, Godalming, Surrey
1875		Butterfield, John Cope, F.I.C., 79, Endlesham-road, Balham, S.W.
1892		Butterfield, William John Atkinson, M.A. (Oxon.), F.I.C., 66, Victoria-street, S.W.
1910	Trans.	Buttle, Bertram Haward, 63, Claremont-road, Forest Gate, E.
1902		Buxy, Tarit Kanti, Prof., Govt. College, Jubbulpore, C.P., India
1888		Byrn, George Alexander, F.I.C., 97, Pitt-street, Sydney, N.S.W.

Date of Election.		
1906		Byrom, Thomas Henry, F.I.C., The Laboratory, Wigan Coa and Iron Co., Ltd., Wigan
1903		Bywaters, Hubert William, D.Sc. (Lond.), Ph.D. (Würzburg) A.R.C.S., F.I.C., The University, Bristol
1903		Cadman, William Henry, B.Sc. (Wales), Ministry of Education Cairo, Egypt
1893		‖Cahill, Robert Saunderson, Sunnyside, Heckmondwike
1894	Trans.	‖Cain, John Cannell, D.Sc. (Vict. and Tübingen), 28, Pembury-road, Clapton, N.E.
1906		Calam, Harold, M.Sc. (Leeds), B.Sc. (Manc.), F.I.C., 71 Cemetery-road, Beeston-hill, Leeds
1898	Proc.	Caldecott, William Arthur, B.A. (Cape of Good Hope), Bo 67, Johannesburg, S. Africa
1891		‖Calder, William Alexander Skeen, Ormidale, Little Moor-hill, Smethwick, near Birmingham
1907	Trans.	Caldwell, Kenneth Somerville, B.Sc. (Wales), Ph.D. (Leipzig) F.I.C., Bankipore, India
1904	Trans.	Caldwell, Robert John, D.Sc. (Lond.), Coventry House, Wilton-avenue, Southampton
1906	Trans.	Caldwell, William, M.A. (R.U.I.), Physiological Department Trinity College, Dublin
1884		Caley, Edward James, Chapel Field Works, Norwich
1907		Callan, Thomas, M.Sc. (Manc.), Ph.D. (Heidelberg), 8, Clevedon-road, Penge, S.E.
1909		Callister, William Edward, B.Sc. (Manc.), 2, Victoria-avenue, Onchan, Douglas, Isle of Man
1903	Trans.	Calvert, Harry Thornton, Ph.D. (Leipzig), M.Sc. (Leeds), B.Sc. (Vict.), F.I.C., West Riding of Yorkshire Rivers Board, Wakefield, Yorks.
1900		Calvert, Sidney, A.M. (Harvard), B.Sc. (McGill Univ.), State University, Columbia, Miss., U.S.A.
1907	Trans.	Cameron, Alexander Thomas, M.A. and B.Sc. (Edin.), Physiological Department, University of Manitoba, Winnipeg, Canada
1875		Cameron, John Macdonald, F.I.C., Castle Hill, Tain, N.B.
1910		Camp, Frank Anthony, c/o Messrs. Parry & Co., Madras, India
1892		Campbell, Andrew, The Palms, Dunneedaw, Rangoon, Burma
1905		Campbell, Eric William, 10, Cambridge-gardens, Richmond Hill, Surrey
1903		Campbell, Thomas, 52, Eastbourne-street, Liverpool
1909		Campbell, Walter, c/o Messrs. J. A. Devenish & Co., Ltd., The Brewery, Weymouth
1898		Campion, Alfred, F.I.C., 144, Wellington-street, Glasgow

Date of Election.		
1896		Candy, Hugh Charles Herbert, B.A. and B.Sc. (Lond.), F.I.C., The College, London Hospital, E.
1898		Cannon, Matthew James, 16 and 17, Devonshire-square, Bishopsgate-street, E.C.
1900		Cantin, Angélo, Prof., Royal College of Mauritius, Vacoas, Mauritius
1910		Canton, Howard, 2, Gloucester-road, Regent's Park, N.W.
1910		Cardoso, Ettore, D. ès Sc. (Grenoble), 3, Grande-rue, Geneva, Switzerland
1888		Carey, Alfred Edward, M.Inst.C.E., 36, Victoria-street, S.W.
1892	Trans.	Carey, Arthur, B.Sc. (Vict.), 1, Grassendale-road, Grassendale, near Liverpool
1909		Carey, William Gordon, A.I.C., c/o The Salt Union, Ltd., Western Point, Runcorn
1906		Carmichael, John, Government Laboratory, Clements Inn-passage, Strand, W.C.
1911		Carmichael, John Fisher, B.Sc. (Vict.), Tower Building, Liverpool
1902		Carmichael, Thomas Burnell, 54, Grant-avenue, Wavertree, Liverpool
1889		Carmody, Patrick, Prof., F.I.C., Department of Agriculture, Port of Spain, Trinidad
1899	Trans.	‖Carpenter, Henry Cort Harold, Prof., M.A. (Oxon.), Ph.D. (Leipzig), The University, Manchester; and 11, Oak-road, Withington, Manchester
1908		Carpenter, John Arthur, B.A, (Oxon.), 23, Richmond-road, Exeter
1906		Carpenter, Percy Henry, F.I.C., c/o Indian Tea Association, Heeleaka Experimental Station, Korea-Kuthia P.O., Assam, India
1899		Carpmael, Wilfred, 24, Southampton-buildings, Chancery-lane, W.C.
1895	Trans.	‖Carr, Francis Howard, F.I.C., Kelvin, Church-avenue, Sidcup, Kent
1887		Carrington, George Carrington, Missenden Abbey, Great Missenden, Bucks.
1902		Carrodus, Fred, Glen Cairn, The Ridgway, Wimbledon, S.W.
1882		‖Carruthers, Robert, Kirkbank House, Dumfries
1893		Carswell, Thomas Retson, 38, Palace-road, Upper Norwood, S.E.
1867		‖Carulla, Facundo Joaquin Ramon, Argyll-terrace, 84, Rose-hill-street, Derby
1895		Case, Thomas Bennett, B.A. (Oxon.), Brewers' Laboratory, Messrs. Guinness, Son & Co., Dublin
1879		‖Cassal, Charles Edward, Col., V.D., F.I.C., Town Hall, Kensington, W.

Date of Election.			
1907	Trans.		Caton, Frederic William, M.A. (Oxon.), B.Sc. (Lond.), Taunton School, Taunton
1903			‖Caudwell, Ben, B.A. (Lond.), 28, Wigfull-road, Sheffield
1909			Caulkin, Howard Alfred, B.Sc. (Lond.), A.I.C., 24, Dairy House-road, Derby
1898	Trans.		Caven, Robert Martin, D.Sc. (Lond.), F.I.C., University College, Nottingham
1902			Challen, Matthew Bradbury, School of Mines, Daylesford, Victoria, Australia
1910	Trans.		Challenger, Frederick, B.Sc. (Lond.), A.I.C., Weenderchaussée 28, Göttingen, Germany
1874			Chaloner, George, South-street, Colyton, Devon
1906			Chamberlain, Percy Garratt, M.A. (Cantab.), 3, Market-place, Rugby
1909			Chambliss, Hardee, Prof., M.S. (Vanderbilt), Ph.D. (Johns Hopkins), Department of Chemistry, Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma, U.S.A.
1883			‖Chambres, Gordon Crewe, Rev., 31, Upper Dicconson-street, Wigan
1883			‖Chance, Alexander Macomb, J.P., c/o Messrs. Chance and Hunt, Ltd., Chemical and Cement Works, Oldbury, Birmingham
1902			‖Chance, Kenneth Macomb, M.A. (Cantab.), c/o The British Cyanides Co., Ltd., Oldbury, Birmingham
1909			Chand, Lakshami, M.A. (Allahabad), B.Sc. (Vict.), c/o Messrs. Ram Chand Bulakidas, Naudau Sahn's-street, Benares City, India
1872			‖Chandler, Charles Frederick, Prof., Ph.D. (Göttingen), Columbia University, West 116th-street, New York City, U.S.A.
1889			‖Chaplin, Edward Mitchell, Ph.D. (Würzburg), F.I.C., Public Analyst's Office, Wakefield
1886	Trans.	C. 1908-10	Chapman, Alfred Chaston, F.I.C., 8, Duke-street, Aldgate, E.C.
1895			Chapman, Arthur Jenner, F.I.C., Baronsmere, Stanhope-avenue, Church-end, Finchley, N.
1898	Trans.		Chapman, David Leonard, M.A. (Oxon.), Jesus College, Oxford
1899	Trans.		Chapman, Edgar Marsh, F.I.C., Cairnsmore, Manor-road, Scarborough
1891			Charles, Rhys Pendrill, F.I.C., Bacteriological Laboratory, King's College, Strand, W.C.
1900			Chater, Arthur Brand, 65, Queen-street, Brisbane, Queensland
1894	Trans.	C. 1900-03	Chattaway, Frederick Daniel, M.A. (Oxon.), D.Sc. (Lond.), Ph.D. (Munich), B.Sc. (Birm.), F.R.S., F.I.C., 103, Woodstock-road, Oxford
1895			Cheadle, Walter William, M.A. (Oxon.), Woodlands, Bridge-road, Grays

Date of Election.			
1899			Cheater, Thomas John, B.Sc. (Lond.), 18, Queen Anne's-grove, Bedford Park, W.
1900			Cheeseright, John Henry, B.Sc. (Lond.), 7, Claremont-place, Gateshead-on-Tyne
1910			Cheetham, Thomas Patrick, Albert-street School, Durban, Natal, S. Africa
1908			Chew, John Henry, 46, Lytham-road, Blackpool
1897	Trans.		Chikashigé, Masumi, D.Sc. (Kyoto), College of Science and Engineering, Imperial University, Kyoto, Japan
1910			Child, Arthur James, Oaklands, Canon's-park, Edgware, Middlesex
1897			Cholerton, Alfred Foster, c/o Messrs. A. de St. Dalmas & Co., 40½, Belgrave-gate, Leicester
1891	Trans.		‖Chorley, John Christmas, Bewsey, Oxford-road, Birkdale, Lancs.
1907			‖Christie, John, B.A. (Cantab.), Eton College, Windsor
1874			Christopher, George, Walkden Works, Verney-road, Bermondsey, S.E.
1911			Christopher, Harold, B.Sc. (Lond.), Mona, Lucien-road, Tooting Common, S.W.
1882			Chrystal, William James, F.I.C., 7, West George-street, Glasgow ; and Shawfield Works, Rutherglen, near Glasgow
1906	Trans.		Chrystall, Edwin Rodney, B.Sc. (Lond.), F.I.C., c/o Messrs. Curtis's and Harvey, Explosives Works, Cliffe-at-Hoo, Kent
1856	Trans.	{C. 1876-80, 87-90}	‖Church, Sir Arthur Herbert, K.C.V.O., M.A. and D.Sc. (Oxon.), F.R.S., F.I.C., Shelsley, Kew, Surrey
1903			Clacher, William, c/o Miss Cuthbert, 33, Upper Kelly-street, Greenock, N.B.
1888	Trans.		Claisen, Ludwig, Geh. Rath Prof., Ph.D. (Bonn), Augustastrasse 24, Godesberg-am-Rheim, Germany
1901	Trans.		Clark, Ernest, B.Sc. (Lond.), Royal Technical Institute, Salford ; and 16, Havelock-street, Sheffield
1892			Clark, Ernest Victor, Woodlands, St. Anne's-crescent, Lewes
1905			Clark, Friend Ebenezer, Prof., B.Sc. (Virg.), Ph.D. (Johns Hopkins), The Central University of Kentucky, Dannville, Ky., U.S.A.
1905			Clark, Thomas Walter Firth, 11, Quadrant-road, Canonbury, N.
1911			Clarke, Arthur Frederick, 12, York-avenue, Gillingham, Kent
1909	Trans.		Clarke, George, Department of Agriculture, Cawnpore, U.P., India
1908	Trans.		‖Clarke, Hans Thacher, B.Sc. (Lond.), A.I.C., Gayton-corner, Harrow
1910	Trans.		Clarke, Herbert Edmund, M.A. and B.Sc. (Oxon.), 20, Grosvenor-road, Jesmond, Newcastle-on-Tyne
1906	Trans.		Clarke, Reginald William Lane, B.Sc. (Lond.), F.I.C., 15, Torridon-road, Catford, S.E.

Date of Election.			
1905			Clarkson, George Douglas, King-street, Mirfield, Yorks.
1902			Claudet, Arthur Crozier, A.R.S.M., F.I.C., 6 and 7, Coleman-street, E.C.
1909	Trans.		Clayton, Arthur, B.Sc. (Lond.), 22, King's-road, Wimbledon, S.W.
1882	Proc.		Clayton, Edwy Godwin, F.I.C., 23, Holborn-viaduct, E.C.
1904			Clayton, Ellis, Hazeldene, Deerpark-road, Belfast
1893			Clayton, George, Northern College of Pharmacy, 100, Burlington-street, Manchester
1889			Clayton, John William, 3 and 5, Concert-street, Liverpool
1908			Clement, Leonard, B.A. (Cantab.), F.I.C., Beamsley, Fairhaven, near Lytham
1875			Clerk, Dugald, F.R.S., 18, Southampton-buildings, Chancery-lane, W.C.
1902			Clifford, William, Sewage Outfall Works, Wolverhampton
1878			Cloud, Thomas Charles, A.R.S.M., F.I.C., 479, Mansion House-chambers, E.C.
1907	Trans.		Clough, George William, B.Sc. (Birm.), Birkbeck College, Breams Buildings, Chancery-lane, E.C.
1902			Clough, William Thomas, A.R.C.S., Chelladene, St. Margaret's-road, Wanstead Park, Essex
1869	Trans.	C. 1885-90, 99-03	‖Clowes, Frank, Prof., D.Sc. (Lond.), F.I.C., The Grange, College-road, Dulwich, S.E.; and 40, Craven-street, Charing Cross, W.C.
1902			Clowes, George Henry Alexander, Ph.D. (Göttingen), Gratwick Research Laboratory, The University, Buffalo, U.S.A.
1897			Clutterbuck, Medwin Caspar, B.Sc. (Lond.), Ph.D. (Strassburg), 61, Beaconsfield-villas, Brighton
1905	Trans.		Coates, Joseph Edward, B.Sc. (Wales), The University, Edgbaston, Birmingham
1887			Coates, William Henry, M.A., M.B. and L.S.A. (Dun.), M.R.C.S., L.R.C.P. and L.S.A. (Lond.), 7, Albion-street, Hull
1896			Cobb, Walter William, M.A. (Oxon.), Hilton House, Atherstone
1890			Cobbold, Paul Alexander, M.A. (Cantab.), Haileybury, Ontario, Canada
1895			Coblentz, Virgil, Prof., Ph.D. (Berlin), 23, Vine-street, Brooklyn, U.S.A.
1880			‖Cockburn, Arthur Cecil, Longfield, Broom-road, Hampton Wick, Middlesex
1906			Cockburn, Charles Taylor, 34, Queen's-gate, Dowanhill, Glasgow
1895	Trans.		Cockburn, George Bertram, B.A. and B.Sc. (Oxon.), Ditchhampton House, Wilton, Salisbury
1901			Cockburn, Thomas, F.I.C., 148, Woodstock-avenue, Shawlands, Glasgow

Date of Election.			
1892			Cockerill, Thomas, Technical College, Colombo, Ceylon
1893			Cocking, Allan Thomas, Carhampton House, Four Oaks, Sutton Coldfield
1888			‖Cocking, Lewis Smith, Rashcliffe Dyewood Mills, Huddersfield
1902			Cockle, Charles, Baslow, Hatherley-road, Winchester
1910			Cocks, Reginald Henry, M.A. (Oxon.), 14, Norbiton-avenue, Kingston-on-Thames
1909	Trans.		Cocksedge, Herbert Edwin, B.A. and B.Sc. (Oxon.), 26, Moss-road, Winnington, Northwich
1901			Coddington, Eustace, M.A. (Cantab.), 131, St. James's-road, Upper Tooting, S.W.
1903			Codling, Arthur John, 5, Tavistock-square, W.C.
1881			‖Coffin, Walter Harris, The National Liberal Club, Whitehall-place, S.W.
1885	Trans.	C. 1908-	Cohen, Julius Berend, Prof., Ph.D. (Munich), B.Sc. (Vict.), F.R.S., The University, Leeds ; and 1, North Grange-mount, Headingley, Leeds
1901			‖Cohen, Robert Waley, M.A. (Cantab.), 11, Sussex-square, W.
1907			Colebourn, William Arthur, 128, Wellington-road-south, Hounslow
1891	Trans.		Colefax, Arthur, M.A. (Oxon.), Ph.D. (Strassburg), M.P., 4, Brick-court, Temple, E.C.
1883			Coleman, Joseph Bernard, F.I.C., S.W. Polytechnic Institute, Manresa-road, Chelsea, S.W.
1909			Coles, Alfred Bertram, M.A. (Oxon.), 42, Broadwater-road, Tottenham, N.
1910	Trans.		Colgate, Reginald Thomas, A.C.G.I., 26, Birdhurst-rise, S. Croydon
1883			Collenette, Adolphus, Brooklyn, Fort-road, Guernsey
1908			Collens, Archibald Edgar, Government Laboratory, Port of Spain, Trinidad
1905	Trans.		Colles, William Morris, jun., B.Sc. (Lond.), Chemical Laboratory, School of Medicine, Cairo, Egypt
1881			Collett, John Marton, Kimsbury House, Gloucester
1910			Collett, Ronald Leslie, B.A. (Cantab.), A.I.C., Little Dawley, Hayes, Hayes End, Middlesex
1885	Trans.	C. 1889-94,1900-1 V.P.1909-	‖Collie, John Norman, Prof., Ph.D. (Würzburg), F.R.S., F.I.C., 16, Campden-grove, Kensington, W.
1908	Proc.		Collier, William Henry, 12, Oxford-gardens, Bayswater, W.
1897			Collingridge, Frank, B.Sc. (Lond.), F.I.C., 73, Fountain-road, Edgbaston, Birmingham
1911			Collington, John Eric, 11, Noel-road, Edgbaston, Birmingham
1892			‖Collins, Hugh Brown, Major, B.Sc. (Glas.), Auchinbothie Estate Office, Kilmacolm, Renfrewshire, N.B.

Date of Election			
1890			‖Collins, Sydney Hoare, M.Sc. (Dun.), F.I.C., Armstrong College of Science, Newcastle-on-Tyne
1888			Collins, Walter Hepworth, Junior Constitutional Club, Piccadilly, W.
1905			Collitt, Bernard, c/o Messrs. Rose and Laflamme, Ltd., 400, St. Paul-street, Montreal, Canada
1887	Trans.		‖Colman, Harold Govett, D.Sc. (Vict.), Ph.D. (Würzburg), F.I.C., Elmside, Worcester Park, Surrey
1890			Colwell, James Kear, F.I.C., Clerkenwell Town Hall, Rosebery-avenue, E.C.
1900			Comber, Albert Walter, F.I.C., Dinwaed, Victoria-avenue, Southend-on-Sea
1892			‖Comyns, Frank, M.A. (Oxon.), Bryum, Craven-road, Newbury,
1899			Connah, James, B.Sc. (Lond.), F.I.C., The Laboratory, Custom House, E.C.
1875			Connor, Charles Cunningham, B.A. (Q.U.I.), 4, Queen's-elms, Belfast
1883			‖Conrad, Edwin Charles, 34, Haslemere-road, Seven Kings, Ilford
1906			Conyngham, William Boulton, Otter Works, Manchester
1875	Trans.		‖Cook, Ernest Henry, D.Sc. (Lond.), F.I.C., The Clifton Laboratory, 27, Berkeley-square, Clifton, Bristol
1895			Cook, Herbert William, B.Sc. (Lond.), The Technical Institute, Tunbridge Wells, Kent
1907			Cook, Taylor, B.Sc. (Lond.), A.R.C.S., Burgh Academy, Kilsyth, Glasgow
1890			Cooke, Arthur William, c/o Messrs. Brotherton and Co., Holmes-street, Dewsbury-road, Leeds
1911			Cooke, Charles Ernest, 35, Sebert-road, Forest Gate, E.
1909			Cooke, Reginald Cyril Herbert, Salisbury Club, Salisbury, Rhodesia, S. Africa
1888			Cooley, Walter Bromley, 5, Dudley-street, Wolverhampton
1909			Coope, John Charles Jesser, Hillside, Bulawayo, Rhodesia, S. Africa
1898			‖Cooper, Albert John Bullen, 80, Gloucester-road, South Kensington, S.W.
1892			Cooper, Arthur James, B.A. (Dub.), B.Sc. (Lond.), F.I.C., Solihull School, Solihull, Birmingham
1888			Cooper, Astley, Stone, Greenhithe, Kent
1908			Cooper, Charles Duncan, Tendercroft, Leyton-avenue, Leigh-on-Sea, Essex
1909			Cooper, George Stanley, Heaton House, Cleckheaton
1906			Cooper, Herbert Reginald, B.Sc. (Lond.), The Grammar School, Witney
1904			Cooper, Jabez Horace, B.A. (Oxon.), 13, Victoria-terrace, Exeter

Date of Election.		
1898		Cooper, John Burdon, M.D., B.S. and B.Sc. (Dun.), 22, The Circus, Bath
1910		Cooper, Leonard Harry, Fern Lea, Trafalgar-drive, Lower Bebington, Birkenhead
1900	Trans.	Cooper, William Francis, B.A. (Cantab.), The Laboratory, Rickmansworth-road, Watford
1891		‖Cooper, Walter Johnson, The Elms, Lavernock, near Penarth
1894	Proc.	Coote, Arthur Herbert, B.Sc. (Lond.), Garwood, 36, Humber-road, Blackheath, S.E.
1899	Trans.	Cope, Frank, Swindon Villa, Dewsbury
1890		‖Coppock, John Bridgeford, B.Sc. (Lond.), F.I.C., Lee-lane, Horsforth, Leeds
1891	Trans.	Corbett, Charles Henry, The Avenue, Trowbridge, Wilts.
1901	Trans.	Cormack, William, Rainsford-road, Chelmsford
1888		‖Cornish, Vaughan, D.Sc. (Vict.), 157, Westbourne-grove, W.
1906		Cornwall, Reginald de Vere, Medical and Public Health Dept., Salisbury, Rhodesia, S. Africa
1890		Corrie, David, Nobel's Explosives Co., West Quarter Factory, Polmont Station, N.B.
1910		Coslett, Thomas Watts, Ivydene, Steel-road, Northfield, Birmingham
1893	Trans.	Coste, John Henry, F.I.C., Utopia, Gloucester-road, Teddington, Middlesex
1909		Couch, David Little, 27, Wilmott-road, Leyton, N.E.
1892		‖Couldrey, Henry, c/o Messrs. Thos. Cook & Son, Ludgate-circus, E.C.
1905		Coupe, Miles, Rosebank, Thornfield-road, Waterfoot, near Manchester
1906	Trans.	Courtauld, Stephen Lewis, B.A. (Cantab.), 2, Friars-walk, Burton-on-Trent
1900		‖Courtman, Ernest Owen, Denford House, Atkins road, Clapham Park, S.W.
1903		‖Cousins, Francis George, B.Sc. (Lond.), 1, St. Cuthbert's-place, Durham
1901	Trans.	Cousins, Herbert Henry, M.A. (Oxon.), Government Laboratory, Kingston, Jamaica
1885		Cousins, William James, F.I.C. 17, Temple-chambers, Temple-avenue, E.C.
1886	Trans.	‖Coutts, Francis James Henderson, M.D., B.Ch., B.Sc., and D.P.H. (Vict.), Rusland, Gloucester-road, Kingston Hill, Surrey
1909	Trans.	Couzens, Edward Gordon, B.Sc. (Lond.), A.R.C.S., 18, Crockerton-road, Upper Tooting, S.W.

Date of Election.		
1910		Coventry, Bernard Okes, Imperial Forest Service, Dehra Dun, U.P., India
1908		Coverdale, Arthur Edward, 68, Broad-street, Worcester
1907	Trans.	Cowap, Matthewman Dalton, Combe Bank, near Sevenoaks
1906	Trans.	Coward, Hubert Frank, D.Sc. (Manc.), 216, Plymouth-grove, Manchester
1898		Cowburn, Arthur William, 20, Mount-street, Manchester
1908		Cowburn, John Robert, 10, Eastwood-road, South Woodford, Essex
1882		‖Cowie, Thomas Rennie, Garnkirk House, Garnkirk, N.B.
1905		Cowie, William Beaverly, 26, East Claremont-street, Edinburgh
1908		Cowley, Robert Charles, College of Pharmacy, Brisbane, Queensland, Australia
1898		Cowling, Frederick, Technical Schools, Clay Cross, near Chesterfield
181		Cowling, Thomas, Chapel-street, Easingwold, Yorks.
1905		Cowman, Douglas Henry Bellars, B.Sc. (Lond.), Heathville-corner, Gloucester
1904		Cowper, Alfred Denys, B.Sc. (Lond.), 8, Sandown-terrace, Deal, Kent
1888		Cowper, Joseph, 50, King-street, Penrith
1898		Cox, Frederick Hudson-, F.I.C., 67, St. Thomas'-street, Weymouth
1873		Cox, Samuel Herbert, 13, St. Helen's-place, E.C.
1904		Crabb, William, B.A. and B.Sc. (Lond.), 5, Edridge-road, Croydo
1870	Trans.	Crafts, James Mason, Prof., 111, Commonwealth-avenue, Boston Mass., U.S.A.
1897	Trans.	Craig, Andrew William, College of Pharmacy, 360, Swanston-street, Melbourne, Victoria
1910		Cram, Marshall Perley, A.M. (Bowdoin), Ph.D. (Johns Hopkins), Bowdoin College, Brunswick, Maine, U.S.A.
1897		Cranfield, William, The Higher Grade Board School, Halifax
1910		Crawford, David Chalmers, M.A., B.Sc. and B.Sc. Agric. (Aberd.), Government College of Agriculture, Elsenburg, Mulders Vlei, Cape Colony, S. Africa
1897		Creasey, Clarence Hamilton, 34, Palm-grove, Oxton, Birkenhead
1909	Trans.	Creighton, Henry Jermain Maude, M.A. (Dalhousie), M.Sc. (Birm.), D.Sc. (Zürich), 43, Church-street, Dartmouth, Nova Scotia, Canada
1909		Crewe, Philip Henry, c/o Messrs. Dakin Bros., Ltd., 82, Middlesex-street, E.
1887		‖Cribb, Cecil Howard, B.Sc. (Lond.), F.I.C., 136, Shaftesbury-avenue, W.
1910		Crichton, Charles, Kleinfontein Group, C.A., Box 2, Benoni, Transvaal, S. Africa

Date of Election.			
1878			‖Criper, William Risdon, A.R.S.M., F.I.C., Chemical Works, Konnagar, Calcutta, India
1907			Crisp, George Hugh, M.A. (Oxon.), B.Sc. (Lond.), 52, Forster-street, West Smethwick, Birmingham
1906			Crocker, Henry Ernest, 2, Reservoir-road, Erdington, Birmingham
1902	Trans.		Crocker, James Codrington, M.A. (Cantab.), D.Sc. (Lond.), South Western Polytechnic, Manresa-road, Chelsea, S.W.; and 15, Bishop's-mansions, Fulham, S.W.
1901			Crocker, Walter Stevens, A.R.C.S., 39, Arnold-street, Princes Park, Liverpool
1897	Trans.		Crofts, James Murray, M.A. (Cantab.), B.Sc. (Lond.), Kelvinside, Fogg-Lane, Didsbury, Manchester
1886	Trans.		‖Crompton, Holland, Oaklyn, Cross Oak-road, Berkhamsted
1911			Crook, Clement Arthur, 5, Avondale-place, Manor-drive, Halifax
1902			Crookes, Henry, 109, Ladbroke-grove, Notting Hill, W.
1901	Trans.		Crookes, Samuel Irwin, Marama-avenue, Owen's-road, Epsom, Auckland, New Zealand
1857	Trans.	C. 1866-70 V.P. 76-9, 85-7 P. 87-9	‖Crookes, Sir William, O.M., D.Sc. (Oxon., R.U.I., Cape of Good Hope), Hon. LL.D. (Birm. and Sheffield), F.R.S., F.I.C., 7, Kensington Park-gardens, W.; and Athenæum Club, Pall Mall, S.W.
1879	Trans.	C. 1890-1, 93-5, 1911-	‖Cross, Charles Frederick, B.Sc. (Lond.), F.I.C., 3, New-court, Carey-street, W.C.
1890	Trans.	C. 1901-2 S. 1905-	‖Crossley, Arthur William, Prof., D.Sc. (Vict.), Ph.D. (Würzburg), F.R.S., F.I.C., Pharmaceutical Society, 17, Bloomsbury-square, W.C.; and 10, Crediton-road, West Hampstead, N.W.
1896			Crossman, Charles Matthew, B.Sc. (Lond.), Cannon House, Watford, Herts.
1895			Crossman, Tom, 70, Stonefall-avenue, Starbeck, Harrogate
1898			Crouch, William Samuel, Hersham, Walton-on-Thames
1880	Trans.		Crow, John Kent, D.Sc. (Lond.), F.I.C., Ivydene, Westcombe-park-road, Blackheath, S.E.
1887			‖Crowther, Horace Woodward, F.I.C., The Beeches, West Bromwich
1884			Crumbie, William Drake, 146, Washington-street, East Orange, N. J., U.S.A.
1911	Trans.		Crymble, Cecil Reginald, B.Sc. (R.U.I.), 7, Upper-crescent, Belfast
1910	Trans.		Cumming, Alexander Charles, D.Sc. (Melbourne), Chemistry Department, The University, Edinburgh
1887	Trans.		Cundall, James Tudor, B.Sc. (Lond.), F.I.C., Edinburgh Academy, Henderson-row, and 1, Dean-park-crescent, Edinburgh

Date of Election.		
1904		Cunningham, James Edward, Minas Peña del Hierro, Provinci del Huelva, Spain
1875		Curphey, William Salvador, F.I.C., 87, Cranfield-gardens, South Hampstead, N.W.
1900		Cussons, John, B.Sc. (Vict.), P.O., Fauresmith, Orange River Colony, S. Africa
1881		‖Custance, John D., Prof., Broad View, Georgetown, S. Australia
1895		‖Cuthbertson, Lionel Mould Gurney, 89, Lordship Park, N.
1911		Cutner, Morris, B.Sc. (Lond.), 21, Bairstow-street, Preston
1894		Dains, Herbert Henry, F.I.C., 7, Mount View-road, Crouch Hill, N.
1901	Trans.	Dakin, Henry Drysdale, D.Sc. (Vict.), F.I.C., 819, Madison-avenue, New York, U.S.A.
1907		Dall, Colin Ernest, B.Sc. (Lond.), 26, Beaconsfield-avenue, Charlton, Dover
1905		Dallman, Arthur Augustine, 111, Penny-lane, Wavertree, Liverpool
1904		Dalton, William Herbert, 85, Hayter-road, Brixton Hill, S.W.
1910		Dand, Middleton Henry, The Brewery, Steyning, Sussex
1901	Trans.	Daniel, Gilbert Howard, B.Sc. (Lond.), 25, Church-walk, Ulverston
1887		Daniell, Louis Charles, Royal Standard Brewery, Tamworth, N.S.W.
1892	Trans.	Darbishire, Francis Vernon, B.A. (Oxon.), Ph.D. (Leipzig), South Eastern Agricultural College, Wye, Kent
1852		Darby, Stephen, F.I.C., Cookham Dean, Berks.
1899		Darling, Charles Robert, A.R.C.S.I., F.I.C., 186, Eglinton-road, Plumstead, Kent
1891		Darling, Thomas, Adderstone House, Berwick-on-Tweed
1871	Trans.	‖Darling, William Howarth, F.I.C., 26, Dover-street, Manchester
1910	Proc.	Das, Tarak Nath, B.Sc. (Allahabad), 31, Bhaironath, Benares City, India
1911		Datta, Atul Chandra, Prof., M.A. (Calcutta), St. John's College, Agra, U.P., India
1911		Datta, Ganesh, B.A. (Punjab), Dera Ismail Khan, N.W.F.P., India
1875		‖Davey, G. William, 22, Tubbs-road, Harlesden, N.W.
1905		Davey, Joseph Morgan, Shelone House, Briton Ferry, Glam.
1897		Davidge, Henry Norris, 23, Rydal-road, Streatham, S.W.
1900		Davidson, Alexander, jun., F.I.C., 173, Colinton-road, Edinburgh

Date of Election.		
1906		Davidson, Charles, 65, Cadder-street, Pollokshields, Glasgow
1907		Davidson, Francis, Myrtle Cottage, Hartop-road, St. Mary Church, Torquay
1876		‖Davidson, Joseph, Green Bank, Holywell-green, Halifax
1898	Trans.	Davidson, William Brown, M.A. and D.Sc. (Aberd.), Ph.D. (Würzburg), F.I.C., Saltley Gas Works, Birmingham
1866	Trans.	‖Davies, Arthur Ellson, Ph.D., Tweedbank, West Savile-road, Edinburgh
1858	Trans.	Davies, Edward, The Laboratory, 28, Chapel-street, Liverpool
1910	Trans.	Davies, John Hughes, B.Sc. (Wales), Ph.D. (Leipzig), St. Peter's College, Peterborough
1905		Davies, John Llewelyn, M.A. (Cantab.), The Perse School, Cambridge
1896		Davies, Llewellyn John, Bute-chambers, Bute-road, Cardiff
1894		Davies, Samuel Henry, B.Sc. (Vict.), Messrs. Rowntree & Co., Ltd., York
1900		Davis, Arthur Charles, 2, Downing-grove, Cambridge
1902		Davis, Charles Benson, c/o Dr. Francis Wyatt, S.W.-corner, 23rd-street and 9th-avenue, New York City, U.S.A.
1902		Davis, Frederick, B.Sc. (Vict.), Prospect House, Wiswell, near Whalley, Blackburn
1902		Davis, Henry Wilson, F.I.C., Farleigh, Crescent-road, Kingston Hill, S.W.
1857		‖Davis, John Frederick, c/o Dr. J. Lewis, Government Analytical Laboratory, Grahamstown, S. Africa
1876		‖Davis, Walter Charles, The Chestnuts, Durdham Down, Bristol
1897	Trans.	Davis, William Alfred, B.Sc. (Lond.), 2, Ashgrove-road, Bromley, Kent
1900		Davison, Thomas Cuthbert, Bower-hill, Exmouth-street, Swindon
1906		Davson, Archibald Prideaux, A.R.C.S., F.I.C., 16, Airedale-road, South Ealing, W.
1900	Trans.	Dawson, Harry Medforth, D.Sc. (Leeds), B.Sc. (Lond.), Ph.D. (Giessen), The University, Leeds; and 25, St. Michael's-crescent, Headingley, Leeds
1909		Dawson, James Ferguson, B.Sc. (Manc.), Vale View, Penicuik, Midlothian
1890		Day, Charles Edwin, B.Sc. (Edin.), The Mines, Coniston, Lancs.
1881	Trans.	‖Day, Thomas Cuthbert, 36, Hillside-crescent, Edinburgh
1905		Day, William Walpole, B.Sc. (Wales), Llandilo, Attleborough-road, Nuneaton

Date of Election.			
1907			Dealy, Thomas Kirkman, Craigmin East, Magazine Gap, Hong Kong, China
1901	Trans.		Dean, George, M.A. (Cantab.), 38, Brisbane-road, Ilford, E.
1904			Deane, Harold, B.Sc. (Lond.), F.I.C., St. Olave's, Sudbury, Suffolk
1886			Deane, Leopold Mandeville, 21, Station-terrace, Abbey Village, near Chorley, Lancs.
1859		V.P. 1871-4	Debus, Heinrich, Prof., Ph.D. (Marburg), F.R.S., Schlangenweg 4, Cassel, Provinz Hessen, Germany
1898	Trans.		‖De Castro, John Paul, M.A. (Cantab.), F.I.C., 1, Essex-court, Temple, E.C.
1885	Trans.		Dechan, Martin, F.I.C., Laboratory of Public Analyst, Hawick
1869	Trans.		‖Deering, William Henry, I.S.O., F.I.C., Chichester Lodge, Babbacombe-road, Torquay
1900	Proc.		Deerr, Noël Fielding, Experiment Station, Hawaian Sugar Planters' Association, Honolulu, H.I., U.S.A.
1902			De la Rue, Evelyn Andros, B.A. (Oxon.), 110, Bunhill-row, E.C.
1905			De Lury, Ralph Emerson, M.A. and Ph.D. (Toronto), The Dominion Astronomical Observatory, Ottawa, Canada
1911			Demuth, Rudolph, 68, Salusbury-road, N.W.
1907	Trans.		Denham, William Smith, D.Sc. (Lond.), F.I.C., The United College, St. Andrews
1892			Denison, Joseph Richard, c/o Messrs. Denison, Preussner & Co., Valley Dyeworks, Bradford
1902			Dennis, William, Saxilby, Lincoln
1906			Denton, John, Moor Bank, Utley, Keighley
1903	Trans.		Desch, Cecil Henry, D.Sc. (Lond.), Ph.D. (Würzburg), F.I.C., Metallurgical Laboratory, The University, Glasgow
1897			‖Deverell, Louis Charles, Brantwood, Shortlands-grove, Shortlands, Bromley, Kent
1911			Devlin, James Edwin Augustine, Hazeldene, Baird-street, Uitenhage, Cape Colony, S. Africa
1870	Trans.	C. 1874-7 V.P. 80-3 86-8, 96-7 P. 97-9	‖Dewar, Sir James, Prof., M.A. (Cantab.), Hon. LL.D. (St. Andrews Aberd., Edin., Glas.), Hon. D.Sc. (Oxon., Dub., Vict. Ireland), F.R.S., F.I.C., Royal Institution, Albemarle-street, W.
1899			Dewhirst, John Arthur, F.I.C., The Borough Laboratory, George-square, Halifax
1880			Dibdin, William Joseph, F.I.C., 2, Edinburgh-mansions Howick-place, Victoria-street, S.W.; and 1, Marlborough-place St. John's Wood, N.W.
1872			‖Dickinson, Arthur John, F.I.C., 178, Lewisham-high-road, Brockley, S.E.
1908	Trans.		Dickinson, Cyril, B.Sc. (Vict. and Leeds), F.I.C., Southwark Town Hall, Walworth-road, S.E.

Date of Election.			
1911			Dickinson, William Henry, Prof. Major, I.M.S., M.B., and Ch.B. (Edin.), F.I.C., Grant Medical College, Bombay, India
1898			Dickson, Samuel, Chemical Laboratory, 2, Broadway, Westminster, S.W.
1910			Dickson, Thomas William, B.A. (Oxon.), 5, Kempsford-gardens, Earls Court, S.W.
1906			Dickson, William, Hillside, Linlithgow, N.B.
1907			Dikshit, Mohan Nath Kedarnath, Amliran, Surat, India
1906			Dinwoodie, James Herbert, 71, Bree-street, Johannesburg, S. Africa
1860	Trans.	C. 1873-4 V P. 1900-03	‖Divers, Edward, Prof., M.D. and Hon. D.Sc. (R.U.I.), F.R.S., F.I.C., 3, Canning-place, Palace Gate, W.
1897			Dixon, Andrew James, F.I.C., 97, Pitt-street, Sydney, N.S.W.
1885	Trans.	C. 1900-06	Dixon, Augustus Edward, Prof., M.D. (Dub.), Queen's College, and Fernhurst-avenue, Western-road, Cork
1896	Trans.		Dixon, Frank, B.Sc. (Lond.), The Institute, Lydney, Gloucester
1894	Proc.		‖Dixon, George, Lieut-Col., M.A. (Cantab.), Trinity College, Cambridge; and St. Bees, Cumberland
1876	Trans.	C. 1892-6 V.P. 1904-7 P. 1909-11	‖Dixon, Harold Baily, Prof., M.A. (Oxon.), Hon. Ph.D. (Prague), F.R.S., The University, Manchester
1893			Dixon, Harry William, 32, Grange-view, Chapeltown-road, Leeds
1895			Dixon, William, 102, Spring-street, Bury
1862			Dixon, William Adam, F.I.C., 97, Pitt-street, Sydney, N.S.W.
1882	Trans.	C. 1901-6 V.P. 1907-11	Dobbie, James Johnston, Prof., M.A. (Glas.), D.Sc. (Edin.), F.R.S., F.I.C., 4, Vicarage-gate, Kensington, W.
1887	Trans.		Dobbin, Leonard, Ph.D. (Würzburg), F.I.C., Chemical Laboratory, New University-buildings, Edinburgh
1910			Dodd, Alexander Scott, B.Sc. (Edin.), A.I.C., 173, Bruntsfield-place, Edinburgh
1910			Dodd, Arthur, Lyndhurst, Belvedere, Kent
1898			‖Dodd, Frederick Robertson, F.I.C., Welbank-villas, Liverpool-road, Aughton, Ormskirk
1901			Dodd, Robert, 56, Valley-road, Streatham, S.W.
1886			Dodd, William Ralph, Burton Grange, Goff's Oak, Waltham Cross
1892			Dodds, George Price, 14, St. Luke's-terrace, Darlington
1905			Dodds, Roger, Kingswood School, Bath
1897	Proc.		Dodgson, John Wallis, B.Sc. (Lond.), University College, Reading
1894	Proc.		Doherty, William Michael, F.I.C., Government Laboratory, Sydney, N.S.W.
1905			Donald, Robert, M.A. and B.Sc. (N.Z.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), D.P.H. (Oxon.), Mental Hospital, Orokonui Home, Waitati, New Zealand

Date of Election.

1892 Donaldson, Hudson, The Laurels, St. Catharine's - road, Grantham

1901 Trans. Donnan, Frederick George, Prof., M.A. (R.U.I.), Ph.D. (Leipzig), F.R.S., Muspratt Laboratory, The University, Liverpool

1897 Trans. Dootson, Frederick William, M.A. (Cantab.), D.Sc. (Dub.), F.I.C., University Chemical Laboratory, Cambridge

1902 Trans. Dorée, Charles, M.A. (Oxon.), D.Sc. (Lond.), 58, Gore-road, N.E.

1899 Dougall, James Dick, Senhouse-street, Maryport, Cumberland

1888 ||Douglas, William, F.I.C., Diamond, Demerara, British Guiana

1905 Doull, John, 22, Lauriston-place, Edinburgh

1911 Douse, Oliver Statham, B.Sc. (Manc.), Fern Bank, Glossop

1884 Down, Frederick Johnathan, Glengariff, Milton-road, Harpenden, Herts

1899 Doyle, Frederick, 3, Etterby-scaur, Carlisle

1884 Draper, Henry Carter, St. Kevin's, Sorrento-road, Dalkey, Co. Dublin

1891 Proc. Dreaper, William Porter, F.I.C., 68, Victoria-street, S.W.

1893 Dreyfus, Charles, Ph.D., (Strassburg), The Clayton Aniline Co., Clayton, Manchester

1902 Drought, James Justinian, Molo, *viâ* Mombasa, British East Africa

1895 Druce, Edric, County Agricultural Institute, Ridgmont, Aspley Guise, Beds.

1904 Trans. Drugman, Julien, Ph.D. (Bonn), 23, Iffley-road, Oxford

1911 Dryden, Harold Edgar, The Laboratory, Messrs. S. Allsopp & Sons, Ltd., Burton-on-Trent

1897 Duckham, Alexander, Phœnix Wharf, West Ferry-road, Millwall, E.

1908 Duckworth, Hugh Cecil, Glendover, St. James'-avenue, Hampton Hill, Middlesex

1907 Duckworth, Samuel, M.Sc. (Vict.), 81, Regent-road, Salford, Manchester

1901 Duckworth, William Henry, Weaste House, Borough-road, Salford

1890 ||Dudley, William Lofland, Prof., Vanderbilt University, Nashville, Tenn., U.S.A.

1892 Duffield, Walter William, 5, Ashington-road, Hurlingham, Fulham, S.W.

1893 Trans. ||Dufton, Samuel Felix, M.A. (Cantab.), D.Sc. (Lond.), Laurel Bank, Claremont-road, Headingley, Leeds

1884 Duggan, Thomas Richard, F.I.C., 60, Foyle-road, Blackheath, S.E.

1889 Duisberg, Carl, Geh. Reg. Rath Prof., Ph.D., Messrs. F. Bayer & Co., Elberfeld, Germany

1889 ||Dukes, Thomas William, P.O. Box 10, Vrijheid, S. Africa

Date of Election.			
1881			Duncan, Arthur William, c/o Messrs. Jas. Woolley, Sons & Co., Ltd., Victoria Bridge, Manchester
1894	Proc.		‖Duncan, Cecil Cooke, F.I.C., The Shire Hall, Worcester
1910			Duncan, James Hugh, 26, Colum-road, Cardiff
1906			Duncan, Robert Kennedy, Prof., 4715, Wallingford-street, Pittsburg, U.S.A.
1891			Duncan, William, F.I.C., The Laboratory, 65, Bath-row, Edgbaston, Birmingham
1896			Duncan, William, Royal Dispensary, 21, West Richmond-street, Edinburgh
1905			Dunlop, Harry, 231, St. Vincent-street, Glasgow
1909	Trans.		‖Dunlop, John Gunning Moore, B.A. (Cantab.), Caius College, Cambridge
1894	Proc.		‖Dunn, Frederic, 193, Collins-street, Melbourne, Australia
1909	Trans.		Dunn, Frederick Percy, B.Sc. (Lond.), Haresfield, Chorley Wood, Rickmansworth, Herts.
1882			Dunn, John Thomas, D.Sc. (Dun.), F.I.C., 10, Dean-street, Newcastle-on-Tyne
1908			Dunnicliff, Horace Barratt, Prof., M.A. (Cantab.), B.Sc. (Lond.), Mohammedan Anglo-Oriental College, Aligarh, U.P., India
1909			Dunningham, Alfred Charles, B.Sc. (Lond.), 245, London-road, Northwich
1893			Dunnington, Francis Perry, University of Virginia, Charlottesville, U.S.A.
1899			Dunscombe, Frederick Charles, c/o Electric Reduction Co., Buckingham, Quebec, Canada
1901	Trans.		Dunstan, Albert Ernest, D.Sc. (Lond.), East Ham Technical College, East Ham, E.
1885			Dunstan, Malcolm James Rowley, M.A. (Oxon.), F.I.C., The College, Wye, Kent
1905			Dunstan, Sydney, The Royal Infirmary, Newcastle-on-Tyne
1879	Trans.	C. 1888-91 S. 1893-03 V.P. 1903-06	‖Dunstan, Wyndham Rowland, Prof., Hon. M.A. (Oxon.), Hon. LL.D. (Aberd.), F.R.S., F.I.C., Imperial Institute, S.W.
1907			Dupré, Frederick Harold, St. Maur, Benhill Wood-road, Sutton, Surrey
1907			Dupré, Percy Vivian, A.C.G.I., F.I.C., St. Maur, Benhill Wood-road, Sutton, Surrey
1871			‖Durham, Henry, 13, Coleherne-road, South Kensington, S.W.
1906			Durrans, Thomas Harold, B.Sc. (Lond.), 10, Titchfield-terrace, North-gate, Regent's Park, N.W.
1883	Trans.		Durrant, Reginald Graham, M.A. (Oxon.), Greenland, Marlborough

Date of Election.			
1908			Dutt, Bidhu Bhushan, Prof., M.A. (Calcutta), Presidency College Calcutta, India
1907			Dutton, Francis Bridger, Birch Hall, Windlesham, Camberley
1892			Duxbury, Thomas, 17, Grosvenor-chambers, Deansgate, Manchester
1909			Dyche-Teague, Francis Clifford, B.Sc. (Birm.), A.I.C., 28, King street, Portman-square, W.
1875	Trans.	C.1893-7 1904-08	‖Dyer, Bernard, D.Sc. (Lond.), F.I.C., 17, Great Tower-street, E.C
1890	Trans.		Dymond, Thomas Southall, F.I.C., Board of Education, Sout Kensington, S.W.
1883	Trans.		‖Dyson, Septimus, Nyddcombe, Warlingham, Whyteleafe, Surre
1905			Eade, Samuel George, 35, Blackborough-road, Reigate
1908	Trans.		Eagles, Edwin Mortimer, M.A. (Cantab.), The Grammar School Enfield, Middlesex
1911			Eardley, James Furnival, Elmsdale, Broomhall-park, Sheffield
1876			‖Earp, Francis Salsbury, Ph.D. (Giessen), F.I.C., 35, Porter-street Kalgoorlie, W. Australia
1907			Eastaugh, Frederick Alldis, A.R.S.M., The University, Sydney N.S.W.
1889	Trans.		‖Easterfield, Thomas Hill, Prof., M.A. (Cantab.), Ph.D. (Würzburg), F.I.C., Victoria University College, Wellington, New Zealand
1891			Eastick, Charles E., Martineau's Refinery, King Edward-street Whitechapel, E.
1881			‖Eastick, John Joseph, A.R.S.M., F.I.C., 49a, Clapton Common N.E.
1908			Easton, Reginald Freeman, 38, Edith-road, West Kensington, W
1903			Eastwood, Arthur William, B.A. (Cantab.), Newton College Newton Abbot
1906			Eaton, Bertie James, F.I.C., Institute of Medical Research Kuala Lumpur, Selangor, Federated Malay States
1878	Trans.		‖Eccles, Herbert, Briton Ferry Steel Works, Briton Ferry Glamorganshire
1909			Edgar, Edward Charles, Dalegarth, Romiley, Stockport
1909			Edge, Alfred, Ravenhurst, Clayton Bridge, Manchester
1909			‖Edge, John Harold, Great Marld, Smithills, Bolton
1906			Edgell, Cecil Wyatt-, B.A. (Oxon.), 87, Merridale-road, Wolverhampton
1903	Proc.		Edgerton, John Percy, St. Lawrence House, 96, Cheapside, E.C.
1902			Edlin, Edgar Leeder, B.A. (Oxon.), 36, Grant-road, Addiscombe, Croydon
1902			Edminson, Sidney Robert, B.Sc. (Lond.), Maritzburg College, Natal, S. Africa

Date of Election.		
1909		Edwards, Frederick Watson, 64, Coppice-side, Swadlincote, Burton-on-Trent
1893		Edwards, Thomas, Ty Mawr, Rhymney, viâ Cardiff
1884		Edwards, Vincent, F.I.C., c/o Lawes' Chemical Manure Co., Barking Creek, Essex
1898		‖Edwards, Wilbraham Tollemache Arthur, M.R.A.C., F.I.C., Municipal Laboratory, Rose-hill, Mauritius
1909	Trans.	Egerton, Alfred Charles Glyn, B.Sc. (Lond.), Chilton House, Thame
1911		Eggington, Alfred Thomas, B.Sc. (Lond.), A.R.C.S., Borlase School, Marlow
1887		‖Ehrhardt, Ernest Francis, D.Sc. (Lond.), Ph.D. (Munich), B.Sc. (Birm.), Badische Anilin und Soda Fabrik, Ludwigshafen-am-Rheim, Germany
1899		Eichenauer, William Frederick, 18, Maryon-road, Old Charlton, Kent
1883		‖Ekins, Arthur Edward, J.P., F.I.C., Rushden, Lattimore-road, St. Albans
1911		Eldridge, Arthur Alfred, B.Sc. (Lond.), A.I.C., School House, Alpha-road, Surbiton, B.O., Surrey.
1903		Elford, Archibald Sefton, M.A. (Oxon.), 41, Broomfield-road, Chelmsford
1891		Elford, Percy, M.A. (Oxon.), 115, Woodstock-road, Oxford
1907		Elias, Owen Aubrey, 123, Waller-road, New Cross, S.E.
1911		Elkington, Algernon John, 26, Rye Hill Park, S.E.
1878	Trans.	‖Elliott, Arthur Henry, Ph.D. (Columbia), 165, Broadway, New York City, U.S.A.
1896	Trans.	Elliott, Walter John, M.A. (Cantab.), Woodcroft, Lichfield-road, Stafford
1893		Ellis, Charles Sordes, F.I.C., Meadowlead, Station-road, Harrow
1900		Ellis, Frederic Richard, 146, Ashley Down-road, Bristol
1903	Proc.	Ellis, Henry Russel, B.Sc. (Lond.), 34, Church-avenue, East Sheen, S.W.
1878		Ellis, William Hodgson, Prof., M.A. (Cantab.), M.B. (Toronto), F.I.C., School of Practical Science, Toronto, Canada
1892		Ellison, Henry, jun., Whitechapel-road, Cleckheaton
1893		Elmore, Alexander Stanley, 72, Gloucester-terrace, Hyde Park, W.
1902	Proc.	Elsden, Alfred Vincent, B.Sc. (Lond.), F.I.C., Chemical Department, Royal Arsenal, Woolwich, S.E.
1885		Embrey, George, F.I.C., City and County Laboratory, 47, Park-road, Gloucester
1911		Emerson, Robert Leonard, A.B. and M.D. (Harvard), 739, Boylston-street, Boston, Mass., U.S.A.

Date of Election.		
1910	Trans.	Emmett, Walter Gidley, B.A. (Cantab.), Mareschal-road Guildford
1887		‖Emmons, Hamilton, The Copse, Hamble, Southampton
1911		Empson, Alfred Walker, A.M.I.E.E., A.M.I.Mech.E., 17 Dhurrumtollah-street, Calcutta, India
1910		Emslie, Benjamin Leslie, 1105, Temple-building, Toronto Canada
1911	Trans.	Enfield, Ralph Roscoe, B.A. and B.Sc. (Oxon.), Toynbee Hall 28, Commercial-street, E.
1901		English, Robert, Christchurch Gas Co., Christchurch, Ne Zealand
1892		Entwistle, Herbert, Fairholme, Redclyffe-road, Palatine-road Manchester
1899		Epps, James Washington, 159, King's-avenue, Clapham Park, S.W
1889		Erskine, James Kerr, New Kleinfontein Co., Ltd., Post Office Benoni, Transvaal, S. Africa
1909		Essex, Harry, jun., 23, Bescot-street, Walsall
1862		‖Esson, William, Prof., M.A. (Oxon.), F.R.S., Merton College Oxford
1865		‖Estcourt, Charles, F.I.C., Seymour House, Seymour-grove, Ol Trafford, Manchester
1899		‖Estcourt, Harry Estcourt, 467, West-street, Durban, Natal S. Africa
1888		‖Estcourt, Philip Anderson, F.I.C., Seymour House, Seymour grove, Old Trafford, Manchester
1894		Eumorfopoulos, Nicholas, B.Sc. (Lond.), 24, Pembridge gardens, W.
1905		Evans, Bernard Scott, B.Sc. (Lond.), A.I.C., 42, Keymer-road, Streatham, S.W.
1904		Evans, Edward, The Laboratory, South Metropolitan Gas Co., 709, Old Kent-road, S.E.
1891		Evans, Frederick Arthur, The Cape Copper Co., Ookiep, Namaqualand, Cape of Good Hope, S. Africa
1906		Evans, Frederick Watkins, 11, High-street, Cardigan
1904		Evans, John, F.I.C., 67, Surrey-street, Sheffield
1904		Evans, Nevil Norton, McGill University, Montreal, Canada
1892	Trans.	‖Evans, Robert Cecil Turle, M.B. and B.S. (Lond.), M.R.C.S. (Eng.), L.R.C.P., L.S.A., D.P.H. and B.Sc. (Lond.), Sandringham House, Marine-crescent, Herne Bay, Kent
1888		‖Everard, Arthur George, 43, Clapham-road, S.W.
1910		Everest, Arthur Ernest, M.Sc. (Birm.), c/o Prof. Willstaetter's Laboratory, Eidgenossisches Polytechnikum, Zürich, Switzerland

Date of Election.			
1908			Everitt, Charles, M.A. (Oxon.), 67, Boston-avenue, Southend-on-Sea
1902			Everitt, Walter, Norwood Wharf, Southall, Middlesex
1894			Evershed, Frank, Kenley, Surrey
1896	Trans.		Ewan, Thomas, M.Sc. (Vict.), Ph.D. (Munich), c/o Cassel Cyanide Co., Ltd., Shuna-street, Maryhill, Glasgow
1909	Trans.		Ewins, Arthur James, B.Sc. (Lond.), 144, Ribblesdale-road, Streatham, S.W.
1902	Trans.		Eynon, Lewis, B.Sc. (Lond.), F.I.C., 57, Darenth-road, Stamford Hill, N.
1901	Trans.		Eyre, John Vargas, Ph.D. (Leipzig), 26, Bridge-road-west, Battersea Park, S.W.
1888			Faber, Harald Nicolai, 7 and 8, Idol-lane, E.C.
1904			Fagan, Thomas Wallace, M.A. (Cantab.), Edinburgh and East of Scotland College of Agriculture, 13, George-square, Edinburgh
1908			Fairburn, Henry, Eastside, Northallerton
1865	Trans.		‖Fairley, Thomas, F.I.C., 17, East-parade, Leeds
1895			Fairrie, Henry, 253, Vauxhall-road, Liverpool
1899			Fairweather, Ernest Barratt, King's College Hospital, Lincoln's Inn Fields, W.C.
1908			Fairweather, James Hill, 62, Wythes-road, Silvertown, E.
1908			Falk, Kaufman George, B.Sc. (Columbia), Ph.D. (Strassburg), 23, East 76th-street, New York City, U.S.A.
1888			Farlie, John Burke, 54, Wellington-road, Old Charlton, Kent
1906			Farmer, Charles George Edgar, 16, Herbert-crescent, S.W.
1907			Farmer, John Edwin, Arran, Alton-road, Waddon, Croydon.
1903	Trans.		Farmer, Robert Crosbie, D.Sc. (L'pool.), Ph.D. (Würzburg), Warbreck, Mount-road, Bexley Heath, Kent
1895			Farr, Edward Henry, Uckfield, Sussex
1910			Farrands, Harry, M.A. (Oxon.), The College, Isleworth
1870			‖Farries, Thomas, F.I.C., 16, Coleman-street, E.C.
1880			‖Farrington, Thomas, M.A. (Q.U.I.), F.I.C., 4, Waterloo-place, Cork
1907			Fawcitt, Claude Scott, 11, St. Mark's-road, Bangalore, India
1887			Fawsitt, Charles Albert, 9, Foremount-terrace, Dowanhill, Glasgow
1903	Trans.		Fawsitt, Charles Edward, Prof., D.Sc. (Edin.), Ph.D. (Leipzig), The University, Sydney, N.S.W.
1906	Proc.		Feilmann, Martin Ernest, B.Sc. (Lond.), Ph.D. (Bâle), F.I.C., 92, Victoria-street, S.W.
1897	Trans.		Fenby, Alarick Vincent Colpoys, B.Sc. (Lond.), Somerville, Woodland-grove, Yeovil
1878	Trans.	C. 1898-1902	‖Fenton, Henry John Horstman, M.A. and Sc.D. (Cantab.), F.R.S., F.I.C., Christ's College, and 19, Brookside, Cambridge

Date of Election.			
1898			Ferguson, James Edward, Laboratory and Assay Office, 2, Unio court, Old Broad-street, E.C.
1872		C. 1889-93	‖Ferguson, John, Prof., M.A. (Glas.), LL.D. (St. Andrews F.I.C., The University, Glasgow
1901			Ferguson, Reginald Williams, B.Sc. (Lond.), A.R.C.S., 57, Linde road, Bournville, Birmingham
1899			Fermor, Herbert Frederick Francis Burdett, 32, Trossacks-roa East Dulwich, S.E.
1909	Trans.		‖Ferraboschi, Frederic, M.A. (Cantab.), 21, Lawrie-park-roa Sydenham, S.E.
1902			Ferrand, Frederick, 13, Torrington-street, Hopwood, Heywood
1882			Ferrier, James, P.O. Box 764, Rome, Georgia, U.S.A.
1902			Ferrier, John Oliver, c/o James Ferrier, Esq., 58, Clock Hous road, Beckenham, Kent; and c/o Sogeri Para Rubber Co., Lt Port Moresby, New Guinea
1902			Ferris, Percy James, Gorse Bank, Thursaston-road, Heswa Cheshire
1906			Field, Samuel, A.R.C.S., Northampton Polytechnic Institu Clerkenwell, E.C.
1904			Field, William Eddington, Martin-street, Elsternwick, Melbour Australia
1911			Fielding, Michael Angelo, 8, St. Joseph's-place, Cork
1895			‖Fielding, Patrick Joseph Dominick, Westbourne, Western-ro Cork
1906	Trans.		Fierz, Hans Eduard, Ph.D. (Zürich), Farben-Extractfabrike vorm J. R. Geigy, Bâle, Switzerland
1900	Trans.		Findlay, Alexander, M.A. and D.Sc. (Aberd.), Ph.D. (Leipzi The University, Edgbaston, Birmingham
1908			Findley, Albert Edward, B.Sc. (Birm.), Dept. of Applied Scien The University, St. George's-square, Sheffield
1905			Findon, Frank Standish, Rev., M.A. and B.Sc. (St. Andrews), Great Percy-street, Holford-square, W.C.
1910			Finlayson, John George, B.A. (Cantab.), 13, Monarch-terra Blaydon-on-Tyne, Co. Durham
1904			Finlow, Robert Steel, B.Sc. (Wales), c/o Messrs. Grind and Co., Calcutta, India
1905	Trans.		Finnemore, Horace, B.Sc. (Lond.), F.I.C., High Leas Coulsdon, Surrey
1907			Fischer, Eugen, Ph.D. (Zürich), c/o Messrs. Kalle & C Aktiengesellschaft, Biebrich-am-Rheim, Germany
1896			Fisher, Ernest Hunter, The County Laboratory, St. Albans
1872	Trans.		‖Fisher, Walter William, M.A. (Oxon.), F.I.C., 5, St. Margare road, Oxford
1873			Fison, Edward Herbert, Stoke House, Ipswich

Date of Election.			
1872			Fison, Sir Frederick William, Bart., M.A. (Oxon.), Boarzell, Hurst Green, Etchingham, Sussex
1906			Fitzgerald, Anthony Nisbet, B.A. and B.Sc. (Lond.), 1, King's-parade, Muswell Hill, N.
1909			Flack, Edmund Victor, Mayville, Wigtown-road, Green Point, Cape Town, S. Africa
1896			Fleet, John Thomas, 24, Sheep-street, Rugby
1899	Trans.		‖Fleischmann, Friedrich Noël Ashcroft, M.A. (Oxon.), 37, Palace-court, Bayswater, W.
1898			‖Fleming, John Arnold, Woodburn, Rutherglen, Glasgow
1874			Fletcher, Frederick William, North London Chemical Works, Holloway, N. ; and Beauchamp Lodge, Enfield
1885		C. 1893-4	‖Fletcher, Lazarus, M.A. (Oxon.), F.R.S., Natural History Department, British Museum, Cromwell-road, S.W. ; and 35, Woodville-gardens, Ealing, W.
1894			‖Flintoff, Robert John, Haxby, York
1892			Floris, Robert Brooke, F.I.C., Heathwood, Woodside-road, Beaconsfield, Bucks.
1906	Trans.		Flürscheim, Bernhard, Ph.D. (Heidelberg), Rushmoor, Fleet, Hants.
1894			Fogg, Charles Albert, Graythorne, Albert-road, Bolton
1859			Fogg, Thomas, 93, Portsdown-road, Maida Vale, W.
1889			Foggie, John, University College, Dundee
1902			Foll, Edgar, The Cottage, The Lion Brewery, Belvedere-road, Lambeth, S.E.
1885			Follows, Harold, 4, Kensington-avenue, Victoria-park, Manchester
1894			‖Forbes, Donald Gordon, Union Club, Victoria, British Columbia
1889	Trans.		Ford, John Simpson, c/o Messrs. W. Younger and Co., Abbey Brewery, Edinburgh
1907			Foreman, Charles Thomas, Jamalpur, East Indian Railway, Bengal, India
1886			Formoy, James Arthur, Chestham, Grange-road, Sutton, Surrey
1904			Forrest, John Kerr, 271, Carlisle-street, St. Kilda, Victoria, Australia
1893			Forrester, Alexander Machattie, c/o Messrs. Laidlaw, MacKill and Co., Ltd., 3400, Williamsburg-avenue, Richmond, Va., U.S.A.
1909			Forrester, George Peters, 69, Beckstrasse, Darmstadt, Germany
1909			Forshaw, Arthur, M.Sc. (Manc.), 104, Holly-road, Handsworth, Staffs.
1910	Trans.		Forster, Aquila, B.Sc. (Dun.), Chem. Laboratorium, Albertstrasse 21, Freiburg i. Baden, Germany

Date of Election.			
1905			Forster, Ernest Lyle Carman, M.A. (Toronto), 317, Queen-street, Ottawa, Canada
1892	Trans.	C. 1901-04. S. 1904-10 V.P. 1910-	‖Forster, Martin Onslow, D.Sc. (Lond.), Ph.D. (Würzburg), F.R.S., F.I.C., Royal College of Science, South Kensington, S.W. ; and 84, Cornwall-gardens, South Kensington, S.W.
1903			Forster, William, 30, Church-street, Seaham Harbour
1856	Trans.	C. 1865-8, 72-5, 85-6. V.P. 88-92.	‖Foster, George Carey, Prof., B.A. (Lond.), LL.D. (Glas.), D.Sc. (Vict.), F.R.S., Emeritus Professor of Physics, University College, Gower-street, W.C. ; and Ladywalk, Rickmansworth, Herts.
1872			Foster, Reginald Le Neve, Fulshaw Cottage, Wilmslow, Manchester
1906			Foucar, James Louis, B.Sc. (Lond.), 15, Morden Road, Blackheath, S.E.
1900			Foulds, James, A.R.C.S., 2, Radfield-road, Darwen
1898			Foulerton, Alexander Grant Russell, F.R.C.S. (Eng.), L.R.C.P., (Lond.), D.P.H. (Cantab.), 1, Morpeth-terrace, Victoria-street, S.W.
1891	Trans.		‖Fowler, Gilbert John, D.Sc. (Vict.), F.I.C., Broad Oak, Urmston, Manchester
1900			Fowler, Morris Broad, 19, Westbury-road, Westbury-on-Trym, near Bristol
1882			‖Fowler, William, 78, Melton-terrace, New Hartley, Seaton Delaval, Northumberland
1909			Fowler, William, Glenwood, Bearsden, Glasgow
1907			Fowles, George, B.Sc. (Lond.), 28, Weltje-road, Hammersmith, W.
1895			Fox, Albert Stanley, Greycote, Westcliff, Herne Bay, Kent
1907	Trans.		Fox, John Jacob, D.Sc. (Lond.), 6, Alkham-road, Stamford Hill, N.
1909			Fox, John Thomas, Stollard-street, Clay Cross, Chesterfield
1907			Foxell, Edward William Lanchester, B.Sc. (Lond.), Barnes, Christ's Hospital, West Horsham, Sussex
1906			Foy, Peter Bertram, 16, Burlington-road, Dublin
1908			Francies, Joseph Valentine, Engineering College, Sibpur, Calcutta, India
1909	Trans.		Francis, Arthur Gordon, B.Sc. (Lond.), F.I.C., 50, Whitbread road, Brockley, S.E.
1879			Francis, Edward, Clifton-lane, Ruddington, Nottingham
1902	Trans.		Francis, Francis Ernest, Prof., D.Sc. (Vict.), Ph.D. (Erlangen) F.I.C., University College, Bristol
1873			‖Francis, George Bult, 22-30, Graham-street, City-road, N.
1881			Frankland, Henry, F.I.C., Streonshalh, The Crescent, Linthorpe Middlesbro'.

Date of Election			
1880	Trans.	C.1887-9 V.P. 1902-05. P. 1911-	‖Frankland, Percy Faraday, Prof., Hon. LL.D. (St. Andrews), Ph.D. (Würzburg), Hon. M.Sc. (Birm.), B.Sc. (Lond.), A.R.S.M., F.R.S., F.I.C., The University, Edgbaston, Birmingham ; and The Dell, Northfield, Birmingham
1867			‖Fraser, Angus, M.A. and LL.D. (Aberd.), M.D., C.M. (Aberd. and Paris), 232, Union-street, Aberdeen
1892			‖Fraser, James Christopher, Austin-street, Adelaide, S. Australia
1885			Freear, Harry Marshall, Ampthill
1887			Freeman, Frederick William, Heatherdale, Spenser-road, Harpenden, Herts.
1900			Freeman, Willie Ludford, M.A. (Oxon. and Dub.), LL.D. (Dub.), The Education Offices, Stoke-on-Trent
1889			Freestone, Joseph Thomas, Limehurst, Plymyard-avenue, Bromboro', Birkenhead
1892	Proc.		French, William, M.A. (Cantab.), F.I.C., Meadowside, Lancaster
1909			Freymuth, William Adolf, Rangoon, Burma, India
1903	Trans.		Friend, John Albert Newton, D.Sc. (Birm.), Ph.D. (Würzburg), Technical College, and 20, Clifton-road, Darlington
1890			‖Frost, Robert, B.Sc. (Lond. and Vict.), 55, Kensington-court, Kensington, W.
1904			‖Fry, George, Carlin Brae, Berwick-on-Tweed
1899	Trans.		Frye, Colin Charlwood, F.I.C., 18, Woodfield-road, Ealing, W.
1880			‖Fryer, Alfred Cooper, M.A. and Ph.D. (Leipzig), F.I.C., 13, Eaton-crescent, Clifton, Bristol
1907			Fryer, Percival John, 27, Minster-road, Cricklewood, N.W.
1909			Fürstenhagen, Otto, c/o Aktien-Gesellschaft für Anilinfabrikation, Berlin, S.O. 36, Germany
1891			Fulcher, Lionel William, B.Sc. (Lond.), Victoria and Albert Museum, S.W. ; and Ingleside, 37, Kempshott-road, Streatham Common, S.W.
1896			Fuller, Charles James Pemeller, 603, Chorley-new-road, Horwich, near Bolton, Lancs.
1909			Furneaux, George Pomeroy, B.A. (Oxon.), Harbour View, Brixham, Devon
1909			Furnell, John Thomas, 32, Grosvenor-park-road, Walthamstow, N.E.
1894			‖Gabb, George Hugh, 83, Crayford-road, Tufnell-park, N.
1899			Gabriel, Edmund Vivian, M.A. (Cantab.), C.V.O., The Pines, Southern-road, Southbourne, Christchurch
1901			Gadd, Henry Wippell, Barrister-at-Law, Common Room, Middle Temple, E.C. ; and 27, East Southernhey, Exeter
1901			Gajjar, Tribhuvandas Kalyandas, Prof., M.A. and B.Sc. (Bombay), Gingaum, Bombay, India

Date of Election.		
1908		Gale, Robert Cecil, A.C.G.I., 38, Scarsdale-villas, Kensington, W.
1905		Gall, John Beaconsfield, A.C.G.I., F.I.C., 49, Glenlyon-road, Eltham Park, Kent
1903		Gandy, William Hunter, Bradley Court, Mitcheldean, Gloucester
1908	Trans.	Ganguli, Atul Chandra, Prof., B.A. (Calcutta), Ravenshaw College, Cuttack, Orissa, India
1883	Proc.	‖Garbutt, Llewellyn, M.A. (Cantab.), The College, Winchester
1909		‖Gardiner, Alexander David, 6, Wellfield-terrace, Springburn, Glasgow
1903		Gardiner, Ernest Alexander, M.A. (Oxon.), The College, Plymouth
1888		Gardiner, James Henry, 59, Wroughton-road, Balham, S.W.
1905		Gardner, Charles Richard, Chemical Laboratory, Gathurst, near Wigan
1911		Gardner, Edgar Harold, 34, Salisbury-avenue, Colchester
1906		Gardner, Edward, Bigwood-road, Meadway, Hendon, N.W.
1909	Trans.	‖Gardner, Henry Dent, M.Sc. (Manc.), 46, The Goffs, Eastbourne
1901		Gardner, Hermann Charles Thomas, Miller Hospital and Royal Kent Dispensary, Greenwich-road, S.E.
1893	Trans.	Gardner, John Addyman, M.A. (Oxon.), F.I.C., Chemical Department, St. George's Hospital, S.W.
1888	Trans.	Gardner, Walter Myers, Prof., M.Sc. (Leeds), Technical College, Bradford; and 3, Fairmount, Manningham, Bradford
1911		Gardner, William Temple, Bruern, Alexandra-road, Upper Parkstone, Dorset
1910	Trans.	Garland, Charles Samuel, B.Sc. (Lond.), A.R.C.S., A.I.C., 57, Garratt-lane, Wandsworth, S.W.
1902		Garle, John Longsdon, F.I.C., 136, Holland-road, Kensington, W.
1893	Trans.	Garnett, Henry, 32, Dover-street, Manchester
1889	Trans.	Garrett, Frederic Charles, M.Sc. (Vict.), 27, Fern-avenue, Newcastle-on-Tyne
1898		Garside, Arthur Leonard Harry, c/o Dr. A. K. Miller, F.I.C., 19, Kilvert's-Buildings, Withy-grove, Manchester
1906		Garvey, Richard Godfrey Hamilton, c/o Commonwealth Oil Corporation, Ltd., Equitable-buildings, George-street, Sydney, N.S.W.
1884		Gaskell, Joseph, 71, Haworth's-buildings, Cross-street, Manchester
1900		Gasson, William, Dutoitspan-road, Kimberley, S. Africa
1903		Gatehouse, Frank Brooks, 3, Lawrence-road, Romford
1904	Trans.	Gawler, Robert, M.Sc. (Vict.), A.I.C., 8, Hope-street, Dewsbury
1887		Geisler, Joseph Frank, Mercantile Exchange Buildings, Hudson and Harrison-streets, New York City, U.S.A.
1885		Gemmell, George Harrison, F.I.C., 4, Lindsay-place, Edinburgh
1903		Gent, Percy William, Trentholme, Misterton, Gainsboro'.

Date of Election		
1879		‖Gent, William Thomas, Misterton, Gainsboro'
1896		George, George, F.I.C., Director of Technical Instruction, Auckland, New Zealand
1889		‖Gerland, Conrad, M.Sc. (Vict.), Ph.D. (Marburg), Meadow Bank, Accrington
1891		German, George, jun., Mansion House, Ashby-de-la-Zouch
1895		‖Gerrans, Henry Tresawna, M.A. (Oxon.), 20, St. John-street, Oxford
1875		Gerrard, Alfred William, Westward Ho, Wake-green-road, Birmingham
1899		Getman, Frederick Hutton, Ph.D. (Johns Hopkins), Dalton Hall, Bryn Mawr College, Bryn Mawr, Penn., U.S.A.
1888		Geyzel, John Lawrence van, Lieut.-Col. I.M.S., M.B. (Aberd.), F.I.C., Indian Store Depôt, Belvedere-road, Lambeth, S.E.
1904		Ghose, Anu, 42, Shambazar-street, Calcutta, India
1890		‖Gibbes, Cuthbert Chapman, M.D. and C.M. (Aberd.), M.R.C.P. (Lond.), D.P.H. (Cantab.), 89, Harley-street, W.
1900		Gibbings, George William, Standard Bank of South Africa, Salisbury, Rhodesia, S. Africa
1897		Gibbons, Joseph Lake, Secondary School, Blyth, Northumberland
1907	Trans.	Gibson, Charles Stanley, M.A. (Oxon. and Cantab.), B.Sc. (Oxon.), M.Sc. (Manc.), Chemical Laboratory, The University, Cambridge
1900		Gibson, John, 15, Tynedale-terrace, Hexham
1892	Trans.	Gibson, John, Prof., Ph.D. (Heidelberg), F.R.S.E., F.I.C., Heriot-Watt College, Edinburgh
1907		Gibson, William Howieson, B.Sc. (Lond.), 23A, Wellington-road, Old Charlton, Kent
1888		Gibson, William Humphrey, 122, King's-road, Brighton
1911		Giddy, Thomas Grantham, High-street, Newcastle, N.S.W.
1895		Gilbard, John Francis Hutchins, F.I.C., 245, Dalston-lane, Hackney, N.E.
1904		Gilchrist, James Gray, M.A. (Aberd.), B.Sc. (Lond.), Blythswood, Victoria-road, Annan, N.B.
1898		Gilderdale, Frederick, 32, Treherne-road, High West Jesmond, Newcastle-on-Tyne
1883		‖Gill, Ernest Clarendon, 10, Barrack-road, Christchurch, Hants.
1888		Gill, John, Gwealhellis, Helston, Cornwall
1902		Gill, J. Arthur, Pennsylvania, Lower-green-road, Rusthall, Tunbridge Wells
1898	Proc.	Gilles, William Setten, A.C.G.I., F.I.C., The Cottage, Bocking, Braintree, Essex
1908	Trans.	‖Gilling, Charles, B.Sc. (Lond.), A.I.C., 30, Carnarvon-road, Barnet, Herts.

Date of Election.		
1901		Gillman, Edward, Government Laboratory, Barbados, West Indies
1897		Girtin, Thomas, M.A. (Cantab.), c/o H. L. Raphael's Refinery, Thomas-street, Burdett-road, Limehouse, E.
1908	Proc.	Girvan, Arthur Frank, B.Sc. (Lond.), 117, Thurlow Park-road, West Dulwich, S.E.
1898		Glaister, John, Prof., M.D. (Glas.), M.R.C.S. and L.R.C.P. (Edin.), 18, Woodside-place, Glasgow
1905		Glass, Archibald Melville, B.Sc. (Lond.), 291, Camden-road, N.
1907		Gledhill, Walter George, M.A. (Cantab.), The School House, Woodbridge
1872		‖Glover, George Thomas, F.I.C., 23, Craven-hill-gardens, Lancaster Gate, W.
1904		Glover, Harry James, Mount Pleasant, Wrattle-road, Westham, near Hastings
1906	Trans.	Glover, Walter Hamis, Ph.D. (Leipzig), 110, Coggeshall-road, Braintree
1907	Trans.	Godden, William, B.Sc. (Lond.), A.R.C.S., F.I.C., 9, Spencer-road, Putney, S.W.
1910		Goddon, George Alexander, 18, Rylett-crescent, Shepherd's Bush, W.
1899		Golding, John, F.I.C., Midland Agricultural and Dairy Institute, Kingston, Derby
1910		Goldsbrough, Harold Albert, A.I.C., Churchside, Herne Hill, S.E.
1878		‖Goldschmidt, Samuel Anthony, Ph.D. (Emory Coll.), 11, Broadway, New York City, U.S.A.
1889		Goldsmith, Byron B., Ph.B. (Columbia), 19, East 74th-street, New York City, U.S.A.
1898		Goldsmith, John Naish, B.Sc. (Vict.), Ph.D. (Heidelberg), 67, Chancery-lane, W.C.
1899		Goltz, Harold Francis Carl, 63, Endymion-road, Brixton Hill, S.W.
1897		Gomess, Alfred Francis Bilderbeck, M.R.C.S. (Eng.), L.R.C.P. (Lond.), 33, Drayton-gardens, South Kensington, S.W.
1911		Gonville, Cyril Herbert Koszelski, 63, The Broadway, Stratford, E.
1904		‖Goodson, John Augustus, F.I.C., Gordon College, Khartoum, Egypt
1896	Trans.	Goodwin, William, M.Sc. (Manc.), Ph.D. (Göttingen), The Midland Agricultural and Dairy College, Kingston, Derby.
1911		Goold, Rowland Lewis, Assoc.Inst.E.E., 5, Corporation-street, Birmingham.
1875		Gordon, Joseph Gordon, F.I.C., Queen Anne's-mansions, Westminster, S.W.
1905		Gorman, Henry Isaac, 126, Quay, Waterford, Ireland

Date of Election.			
1909	Trans.		Gortner, Ross Aiken, M.A. (Toronto), B.Sc. (Nebraska), Ph.D. (Columbia), Carnegie Institution, Station for Experimental Evolution, Cold Spring Harbour, Long Island, N.Y., U.S.A.
1890			Gossling, Frank, B.Sc. (Lond.), H.M. Patent Office, Staple Inn, W.C.
1889	Trans.		‖Gott, Benjamin Scaife, M.A. (Cantab.), The Guildhall, Westminster, S.W.
1897	Trans.		Goulding, Ernest, D.Sc. (Lond.), F.I.C., 88, Sylvan-avenue, Chitts Hill, N.
1887			Gover, Herbert James, 29, Piccadilly, Hanley, Staffs.
1889			Gow, Robert John, Ivy Lea, Hough Green, near Widnes
1893			Gower, Alfred Roland, Ashleigh, Furness-park-road, Barrow
1871	Trans.	C. 1898-01, 1906-7	‖Gowland, William, Prof., A.R.S.M., F.R.S., F.I.C., 13, Russell-road, Kensington, W.
1887	Trans.		Goyder, George Arthur, 110, Gawler-place, Adelaide, S. Australia
1880	Trans.		‖Graham, Christopher Colborne, F.I.C., Oriel House, Scarborough
1910			Gramont, Count Arnaud de, D. ès Sc., 179, Rue de l'Université, Paris, France
1890	Trans.		Grant, James, M.Sc. (Manc.), F.I.C., Oaklands, Gardner-road, Prestwich, near Manchester
1887			Gravill, Edward Day, 42, Walmsley-street, Hull
1882			‖Gray, George, Canterbury Agricultural College, Lincoln, New Zealand
1900	Trans.		Gray, Robert Whytlaw, Ph.D. (Bonn), University College, Gower-street, W.C.
1892	Trans.		‖Gray, Thomas, Prof., D.Sc. (Glas.), Ph.D. (Jena), The Technical College, Glasgow
1895			Greaves, William Abraham, B.Sc. (Lond.), 23A, Broad-bank, Louth, Lincs.
1885	Trans.	C. 1894-5	‖Green, Arthur George, Prof., Hon. M.Sc. (Vict.), F.I.C., The University, Leeds; and 49, Cardigan-road, Headingley, Leeds
1902	Trans.		Green, Clarence James, B.Sc. (Vict.), c/o Messrs. Nicholson and Co., Beaumont Works, St. Albans
1905			Green, Ernest, 98, Cheadle-road, Cheadle Hulme, Stockport
1908			Green, Henry Hamilton, 36, Princes-square, Regent-park, Glasgow
1878			Green, Herbert, Hayle Mill, Maidstone
1887			Green, John Edward, A.R.S.M., F.I.C., West Clyne, Stretford, Manchester
1909			Green, John Wilberforce, 42, Dunmore-road, Wimbledon, S.W.
1878			Green, Lawrence, Lower Tovil, Maidstone

Date of Election.		
1908		Green, Leonard Clifford, B.E. (Sydney), Wienholt-street, Torwood, Brisbane, Queensland
1907		Green, William Heber, D.Sc. (Melbourne), The University, Melbourne, Australia
1874	Trans.	‖Greenaway, Alfred John, F.I.C., The Orchard, Chertsey, Surrey
1907		Greenough, Thomas Rigby, B.A. (Cantab.), A.I.C., Beechwood, Leigh, Lancs.
1885		Greenway, Thomas John, F.I.C., 369, Collins-street, Melbourne, Australia
1894	Proc.	Greeves, Alfred, B.Sc. (Lond.), A.R.C.S., A.I.C., 25, Balmuir-gardens, Putney, S.W.
1891		Gregory, Alfred John, M.D. and B.S. (Dun.), M.D. (Cape of Good Hope), M.R.C.S. and D.P.H. (Eng.), Department of Public Health, Cape Town, S. Africa
1907		Gregory, Joshua Craven, B.Sc. (Lond.), F.I.C., 128, Wellington-street, Glasgow
1906	Trans.	Gregory, Thomas William Diggle, Kinross, Trentham, Stoke-on-Trent
1896		Grice, Walter Thomas, 9, Dalhousie-square, Calcutta, India
1907		Grieb, Christopher Maurice Walter, B.Sc. (Lond.), F.I.C., 33, Torrington-park, N. Finchley, N.
1910		Grieve, James, 30, Bridge-street, Hawick, N.B.
1908		Griffin, John, B.A. (Cantab.), St. John's College, Battersea, S.W.
1888		‖Griffith, David Agnew, 87, Demesne-street, Seacombe, Birkenhead
1911		Griffiths, Evan Dalton, B.Sc. (Wales), East Ham Technical College, East Ham, E.
1905		Griffiths, John, B.Sc. (Wales), The Grammar School, Larne, Ireland
1902		Griffiths, John Thomas, B.Sc. (Lond.), 9, Greenhill-avenue, Tenby, S. Wales
1879		Griffiths, Thomas, The Cedars, Clapham Common, S.W.
1895		Grime, Herbert, 3, Hill-side, Lancaster
1902		Grimwade, Wilfrid Russell, B.Sc. (Melbourne), 342–346, Little Flinders-street, Melbourne, Australia
1893		Grimwood, Robert George, F.I.C., 43, Leaside-avenue, Muswell Hill, N.
1906		Grindley, Harry Sands, Prof., D.Sc. (Harvard), B.Sc. (Illinois), State University, Urbana, Ill., U.S.A.
1889		Gripper, Harold, Chapel-lane, Wilmslow, Cheshire
1909		Grist, Charles James, Elgin House, Knockholt, Sevenoaks
1900		Gritton, Henry Bertie, The Royal Mint, Sydney, N.S.W.
1895		Grossmann, Edward Henry, 12, Alfred-place-west, South Kensington, S.W.

Date of Election.			
1871	Trans.	C. 1877-8 1909- V.P. 1899-02	‖Groves, Charles Edward, F.R.S., F.I.C., Kennington Green, S.E.
1905			Groves, Samuel Ernest, 3, Ripon-gardens, Jesmond, Newcastle-on-Tyne
1901			Groves, William Peer, B.A. (Cantab.), Green Bank, Plumbley, Cheshire
1906			Grubb, David Paton, B.Sc. and B.Sc.Eng. (Edin.), A.R.S.M., 17, Victoria-road, Barnsley
1897			Grundey, Frederick Roscoe, B.Sc. (Vict.), Edale, Albany-road, Douglas, Isle of Man
1910			Guhlmann, Charles Frederick, Grantwood, Bergen Co., N.J., U.S.A.
1902			Gumersall, Edward, 34, Freegrove-road, N.
1895			Gunn, Alexander, 50, Chelsham-road, Clapham, S.W.
1902			Gunn, Gilbert, 181, Bury-new-road, Heywood, Lancs.
1906			Gupta, Hem Chandra Dutt, Prof., M.A. (Calcutta), Gupta-Nibas, Krishnagar, Dist. Nadia, Bengal, India
1898			Guthrie, Alexander, B.Sc. (Lond.), c/o Messrs. S. Courtauld & Co., Ltd., Bocking, Braintree
1888	Trans.		Guthrie, Frederick Bickell, F.I.C., Chemical Laboratory, Department of Agriculture, Sydney, N.S.W.
1904	Trans.		Guthrie, John Monteath, 199, Ferry-road, Leith, N.B.
1904	Trans.		Guttmann, Leo Frank, Ph.D. (Heidelberg), A.C.G.I., F.I.C., 60, Mark-lane, E.C. ; and 18, Aberdare-gardens, N.W.
1902	Trans.		Haas, Paul, D.Sc. (Lond.), Ph.D. (Freiburg), 11, Westbourne-park-road, W.
1910	Trans.		Hackford, John Edward, A.I.C., c/o Messrs. W. Ropes & Co., St. Petersburg, Russia
1894			Hadley, Arthur, c/o Messrs. Georges Brewery, Ltd., Bristol.
1893			‖Hadley, Henry Edwin, B.Sc. (Lond.), A.R.C.S., School of Science, Kidderminster
1886	Trans.		Haga, Tamemasa, Prof., D.Sc. (Japan), College of Science, University of Tokio, Japan
1881			Hailes, Alfred James de, F.I.C., 15, Red Lion-square, W.C.
1892			Haines, Walter Stanley, Prof., c/o Rush Medical College, Chicago, Ill., U.S.A.
1876	Trans.		Hake, Henry Wilson, Ph.D. (Giessen), F.I.C., Westminster Hospital Medical School, Caxton-street, S.W.
1893			Hale, Henry Ormsby, M.A. (Cantab.), Oundle School, Oundle
1891	Trans.	C. 1904–7	Hall, Alfred Daniel, M.A. (Oxon.), F.R.S., Lawes Agricultural Trust, Rothamsted Experimental Station, Harpenden, Herts.
1889			Hall, Allan Twistleton, c/o Messrs. Sissons Bros. and Co., Ltd., Hull

Date of Election		
1891		Hall, Archibald, F.I.C., 7, Fenchurch-avenue, E.C.
1911		Hall, Arthur Bennett, 31, Dyer-street, Kirkham, Preston
1889	Trans.	Hall, John Albert, Lieut.-Col., M.Sc. (Manc.), Longston Esquimault-road, Victoria, B. Columbia.
1903		Hall, John Thomas, West View, Stanwell, Staines
1906		Hall, Octavius, L.R.C.P. and L.R.C.S. (Edin.), L.F.P.S. (Glas.) D.P.H. (R.C.P.S.I.), 7, Albemarle-villas, Devonport
1899		‖Hall, Samuel Godfrey, c/o Messrs. Edward Cook & Co., Works Bow, E.
1908		Hall, William, B.Sc. (Vict.), Municipal Technical School The Newarke, Leicester.
1886		Halliburton, William Dobinson, Prof., M.D., B.Sc. and F.R.C.P. (Lond.), M.R.C.S., (Eng.), F.R.S., Church Cottage, 17, Marylebone-road, N.W.
1897		Halliwell, Edward, F.I.C., c/o Ribble Joint Committee, 2, Stanley-place, Preston
1902		Hallowell, Thomas Butterworth, Ladyshawe House, New Mills, West Stockport
1900		Halstead, Reginald Gordon, 12 and 16, Coleman-street, E.C.
1888	Trans.	Hamilton, James Cullen, Barrows-green, near Kendal, Westmoreland
1898		Hamilton, Oswald, Old Stratford, Stony Stratford, Bucks.
1897		Hamilton, Robert, 3, Westminster-terrace, Ibrox, Glasgow
1875	Trans.	Hamlet, William Mogford, F.I.C., Government Laboratory, Macquarie-street, Sydney, N.S.W.
1904		Hammond, Harold Sankey, Macdonald College, St. Anne de Bellevue, Quebec, Canada
1901		Hammond, Herbert Blackmore, 101, Barton-road, Dover
1911	Trans.	Hampshire, Charles Herbert, B.Sc. (Lond.), 17, Bloomsbury-square, W.C.
1857		Hanbury, Cornelius, F.I.C., Plough-court, Lombard-street, E.C.; and Manor House, Little Berkhamsted, Hertford
1900		Handcock, Walter Augustus, F.I.C., Pentlands, 39, The Avenue, Beckenham, Kent
1910		Handley, John, Box 124, Sudbury, Ontario, Canada
1895	Trans.	Hanes, Edgar Septimus, F.I.C., 34, Sarre-road, West Hampstead, N.W.
1910		Hanley, John, F.I.C., 74, Rowson-street, New Brighton, Cheshire
1872	Trans.	‖Hannay, James Ballantyne, F.I.C., Cove Castle, Loch Long, N.B.; and The Rectory, Greenford, Southall
1889		‖Hanson, Alfred Miall, The Marjorie, Whalley, near Blackburn

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901	Trans.		Hanson, Edward Kenneth, M.A. (Cantab.), F.I.C., Woodthorpe, Royston-park-road, Hatch End, Middlesex; and 2A, The Parade, High-street, Watford
906			Hanson, Harold Norman, Field Head, Brighouse, Yorks.
895			Hanson, Weldon, Westwick, Ashville-avenue, Norton, Stockton-on-Tees
897			Harbord, Frank William, A.R.S.M., F.I.C., Surbiton House, Englefield Green, Surrey
859	Trans.	S.1865-73, V.P.73-6, 80-3, 92-5 P. 1895-7	‖Harcourt, Augustus George Vernon, M.A. and Hon. D.Sc. (Oxon.), Hon. D.C.L. (Dun.), Hon. LL.D. (Montreal), F.R.S., F.I.C., St. Clare, Ryde, Isle of Wight
887	Trans.	C. 1902–05	‖Harden, Arthur, D.Sc. (Vict.), Ph.D. (Erlangen), F.R.S., F.I.C., 2, Marlborough-road, Richmond, Surrey
911			Harding, Henry George Alan, Darling-street, Chatswood, Sydney, N.S.W.
901			Harding, Herbert, B.Sc. (Lond.), 47, Streathbourne-road, Upper Tooting, S.W.
909	Trans.		Harding, Victor John, M.Sc. (Manc.), McGill University, Montreal, Canada
892			Hardy, James Gordon, c/o The Creston Colorado Mining Co., Torres Sonora, Mexico
909			Hargreaves, Egerton, M.Sc. (Manc.), Arthog, Garner's-lane, Davenport, Stockport
876			Hargreaves, James, Peel House-lane, Farnworth, near Widnes, Lancs.
884			Hargreaves, John, F.I.C., Widnes, Lancs.
900			Hargreaves, William Arthur, M.A. and B.C.E. (Melbourne), F.I.C., Globe-chambers, Victoria-square-west, Adelaide, S. Australia
900			Harker, George, D.Sc. (Lond.), 35, Boulevarde, Petersham, Sydney, N.S.W.
909			Harland, Robert Main, 37, Lombard-street, E.C.
878			‖Harland, William Dugdale, 48, King-street, Manchester
897			‖Harley, Vaughan Berkeley, Prof., M.D. (Edin.), M.R C.P. (Lond.), 25, Harley-street, W.
897			Harman, Harold Wallis, 90, Palace-road, Tulse Hill, S.W.
903			Harmer, Francis Gerald, Cockburn High School, Leeds
899			Harper, Henry Winston, M.D. (Virginia), The University of Texas, and 2216, Rio Grande-street, Austin, Texas, U.S.A.
907			Harrington, Arthur George, F.I.C., c/o Dr. Middleton, Municipal Buildings, Singapore, Straits Settlements
881			Harrington, William Bury, Leeview, Montenotte, Cork
906			Harris, Frederick James, Hem Heath, Trentham, Stoke-on-Trent
896			Harris, Frederick William, F.I.C., 26, John-street, Glasgow

Date of Election.			
1893			Harris, Harold, The Birmingham Metals and Munitions Co., Ltd. Ammunition Factory, Streetly, nr. Sutton Coldfield, Birmingha
1895			Harris, Harry, A.R.S.M., c/o The Tasmanian Smelting Co. Ltd., Zeehan, Tasmania
1894			Harris, Sydney Walters, Devon House, Walter-road, Swansea
1878			‖Harris, Thomas Frederick, B.Sc. (Lond.), Avondale, Thorp St. Andrew, Norwich
1894	Trans.		Harrison, Edward Frank, B.Sc. (Lond.), F.I.C., 55, Chancery lane, W.C.; and Langholm, Edgar-road, S. Croydon
1910			Harrison, Edwin, Hillside, Dudding Hill-lane, Neasden, N.W.
1901			Harrison, John Ansted, B.Sc. (Lond.), A.R.C.S., The Hoste Diss
1888			Harrison, John Burchmore, C.M.G., M.A. (Cantab.), F.I.C. Government Laboratory, Georgetown, Demerara, Britis Guiana
1902			Harrison, Walter Ernest, 17, Soho-road, Handswort Birmingham
1901			Harry, Frederick Thomas, 106, Sandmere-road, Clapha Common, S.W.
1886			Hart, Bertram Harvey, Rosslyn, High-street, Sidcup, Kent
1900			Hart, Herbert-William, 5, Cambridge-road, Ansdell, Lytham Lancs.
1891			Hart, William Beamont, F.I.C., Laboratory, 8, Exchange-stree Manchester
1882			Hartley, Arthur, The Brewery, Emsworth, Hants.
1897	Trans.		Hartley, Ernald George Justinian, B.A. (Oxon.), The Bungalow Foxcombe Hill, near Oxford
1899	Trans.		Hartley, Harold Brewer, M.A. (Oxon.), Balliol College, Oxford
1897			Hartley, Thomas, B.Sc. (Lond.), F.I.C., Swindon and Nort Wilts. Technical School, Swindon
1866	Trans.	C. 1877-80 V.P. 90-3	†Hartley, Sir Walter Noel, Prof., Hon. D.Sc. (R.U.I.), F.R.S. F.I.C., Royal College of Science, St. Stephen's-green-east and 10, Elgin-road, Dublin
1890	Trans.		Hartog, Philip Joseph, M.A. (Manc.), B.Sc. (Lond. and Vict.) University of London, South Kensington, S.W.
1900	Trans.		‖Hart-Smith, James, A.R.C.S., F.I.C., 4, Grafton-mansions, Venn-street, Clapham, S.W.
1900	Trans.		Harvey, Alfred William, 13, Pendrell-road, St. Catherine's-park, Hatcham, S.E.
1909			Harvey, Arthur John, 88a, East India Dock-road, Poplar, E.
1885			Harvey, Ernest William, A.R.S.M., Stoneleigh, 23, Grove-road, Clapham Park, S.W.

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† Longstaff Medallist, 1906.

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881		Harvey, Sidney, F.I.C., Watling House, Canterbury
907		Harvey, Thomas Featherstone, 69, North-road, West Bridgford, Nottingham
894		Harvey, William Pellew, 62, London Wall, E.C.
911		Harwood, Henry Francis, M.Sc. (Manc.), Ph.D. (Heidelberg), Royal College of Science, S. Kensington, S.W.
894		Hatfield, John Adams, F.I.C., c/o Messrs. J. Lysaght, Ltd., Orb Iron Works, Newport, Mon.
892		Hatton, William Percy, c/o Messrs. W. R. Hatton and Sons, Ltd., Wormwood Scrubs, W.
880		Hawkes, Alfred Edward, M.D. (Brussels), L.R.C.P. (Edin.), Muspratt Laboratory, The University, Liverpool
894	Trans.	Haworth, Edward, D.Sc. (Vict.), Ivy Bank, Moughland-lane, Runcorn
898		Haworth, John, 117, Millhouses-lane, Sheffield
909	Trans.	Haworth, Walter Norman, D.Sc. (Manc.), Ph.D. (Göttingen), Royal College of Science, S. Kensington, S.W.
909		Haws, John Frederick, 27, Trafford-chambers, South John-street, Liverpool
905	Trans.	Hawthorne, John, B.A. (R.U.I.), Ph.D. (Jena), F.I.C., 16, Donegall-square-south, Belfast
907		Hay, William, Holton House, Beverley-road, Hull
910		Haycock, John, Hill Top House, Great Glen, Leicester
910	Trans.	Hayhurst, Walter, M.Sc. (Manc.), Pannal Ash College, Harrogate
905		Hayman, Jack Vernon Johnson, A.C.G.I., A.I.C., c/o Société Anonymé des Ciments, Massarah, Ligne de Helouan, Cairo, Egypt
1900		Haynes, James Herbert, B.Sc. (Vict.), Sennen, 65, Kennington-avenue, Ashley Down, Bristol
1909		Hayward, Eric, A.I.C., c/o W. R. Criper, Esq., Konnagar House, Konnagar, near Calcutta, India
1906		Hayworth, William Prince, F.I.C., 70, Highfield-road, Dartford
1903		Heasman, Harold Montague, 2, Broadway, Westminster, S.W.
891		Heath, John William, 1, Carlyle-square, Chelsea, S.W.
898		Heaton, John, Southcliffe, Roker, Sunderland
902		Heaton, Noël, B.Sc. (Lond.), Denmark House, Stonebridge Park, N.W.
908		Hebron, John Henry Albert, B.Sc. (Lond.), Beechwalk, Littleover, Derby
906	Trans.	Hedley, Edgar Percy, Ph.D. (Leipzig), A.R.C.S.I., Esplanade-mansions, Durban, Natal, S. Africa
899		Hedley, George Ward, M.A. (Oxon.), The College, Cheltenham
905		Heely, Frederick William, 88, Corporation-road, Grimsby

Date of Election.			
1876		C. 1895-9	Hehner, Otto, F.I.C., 11, Billiter-square, E.C.
1889			Helbing, Heinrich B., 63, Queen Victoria-street, E.C.
1875			‖Hellon, Robert, Ph.D. (Heidelberg), A.R.S.M., F.I.C., Whinthwaite, Seascale, viâ Carnforth
1872			‖Helm, Henry James, I.S.O., F.I.C., Simonstone, 27, Hammelton road, Bromley, Kent
1899			Hembrough, James, A.R.C.S., A.I.C., Science, Art an Technical School, Market-street, Newton Abbott
1900			Hemingway, Frank Christian Richard, 133, Front-street, Ne York City, U.S.A.
1898	Trans.		Hemmy, Arthur Stanley, Prof., B.A. (Cantab.), M.Sc. (Melbourne) Government College, Lahore, India
1885	Trans.		‖Henderson, George Gerald, Prof., M.A., D.Sc. (Glas.), F.I.C. The Technical College, 204, George-street, Glasgow
1895	Trans.		Henderson, James, Ph.D. (Münich), B.Sc. (St. Andrews), c/ Horlick's Malted Milk Co., Racine, Wisconsin, U.S.A.
1905			Henderson, James Alexander Russell, Prof., B.Sc. (Glas.), Chihl Provincial College, Paotingfu, N. China, via Siberia
1900	Trans.		Henderson, John Brownlie, F.I.C., Government Analyst, Brisban Queensland
1892			Hendrick, James, B.Sc. (Lond.), F.I.C., Marischal College Aberdeen
1903			Hendrickson, Arthur V., The Gas Works, Lower Sydenham, S.E
1909			Hendry, Robert Douglas, 16, Church-street, Alloa, N.B.
1901			‖Henley, The Hon. Francis Robert, M.A. (Oxon.), F.I.C. 9, Beaufort-gardens, S.W.
1905			Hennings, Carl Richard, Ph.D. (Freiburg), 19, St. Dunstan's-hill E.C.
1899	Trans.		‖Henry, Thomas Anderson, D.Sc. (Lond.), 70, Doneraile-street Fulham, S.W.
1905	Trans.		Henstock, Herbert, M.Sc. (Vict.), Ph.D. (Zürich), Wilcot House, Wilcott, near Nesscliffe, Shrewsbury
1904			Henzell, Archie Willoughby, Prof., Imperial Provincial College Chinanfu, Shantung, China
1895			Heriot, Thomas Hawkins Percy, 24, Woodberry-crescent, Muswel Hill, N.
1871			Herman, Douglas, F.I.C., Rainhill, Lancs.
1876	Trans.	C. 1892-3	Heron, John, B.E. (R.U.I.), F.I.C., 110, Fenchurch-street E.C.
1908			Heron, John Maxwell, North House, Mistley, Essex
1906			Herty, Charles Holmes, Prof., Ph.D. (Johns Hopkins), Ph.B. (Georgia), University of North Carolina, Chapel Hill, N.C., U.S.A.

ate of lection.			
892	Trans.	C. 1903-05, 1908-11	Hewitt, John Theodore, M.A. (Cantab.), D.Sc. (Lond.), Ph.D. (Heidelberg), F.R.S., Clifford House, Staines-road, Bedfont, Feltham, Middlesex
900			Hewitt, Samuel, 53, Dover-street, Unthank-road, Norwich
892			Hewlett, John Cooke, 35–42, Charlotte-street, Great Eastern-street, E.C.
883	Trans.	C. 1897–1901	‖Heycock, Charles Thomas, M.A. (Cantab.), F.R.S., 3, St. Peter's-terrace, Cambridge
909	Trans.		Hibbert, Harold, M.Sc. (Vict.), Ph.D. (Leipzig), F.I.C., Experimental Station, E. I. du Pont de Nemenos Powder Co., Henry Clay P.O., Wilmington, Delaware, U.S.A.
876	Trans.		Hibbert, Walter, F.I.C., 144, Walm-lane, Willesden Green, N.W.
909			Hickinbotham, Reginald Vernon, 144, West-street, Maritzburg, Natal, S. Africa
881			‖Hiddingh, Michael, Newlands, near Capetown, S. Africa
905			Higgins, John Michael, 39, Queen-street, Melbourne, Australia
907			Higham, Richard, 133, Mauldeth-road, Withington, Manchester
909			Higson, Frank, Ivybank, Castle-street, Haulgh, Bolton
908	Trans.		Hilditch, Thomas Percy, D.Sc. (Lond.), F.I.C., 48, Pemberton-road, Harringay, N.
882			‖Hill, Alexander, 4, Broad-street-place, E.C.
896	Trans.		Hill, Arthur Croft, M.A., M.D. and B.S. (Cantab.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), 169, Cromwell-road, S.W.
906	Trans.		Hill, Arthur Edwin, c/o A. A. Hill, Esq., Constantinople
896			‖Hill, Charles Alexander, B.Sc. (Lond.), F.I.C., 26, Courtfield-gardens, S.W.
896	Trans.		Hill, Ernest George, Prof., Sc.D. (Dub.), B.A. and B.Sc. (Oxon.), Muir College, Allahabad, India
905			Hill, William Basil, Eastfield, Stockton-lane, York
894			‖Hills, Edmond Herbert, Capt. R.E., F.R.S., 32, Prince's-gardens, S.W.
892			‖Hills, Harold Fletcher, Commercial Gas Works, Stepney, E.
906			Hills, James Stuart, F.I.C., Oxford Works, Tower Bridge-road, S.E.
898			Hills, Thomas Herbert, 30, High-street, Harlesden, N.W.
873			‖Hills, Walter, 50, Wigmore-street, W.
896			Hinchley, John William, A.R.S.M., 55, Redcliffe-road, S.W.
908			Hinks, Edward, B.Sc. (Lond.), F.I.C., 16, Southwark-street, S.E.
900			Hinks, Percy John, A.R.C.S., F.I.C., Woodstock, Beaconsfield-road, Blackheath, S.E.
394			Hirsch, Charles Theodore William, M.R.C.S. (Eng.), L.R.C.P. (Lond.), Charlinch, Rectory-road, Woolwich, S.E.
370			Hislop, George Robertson, Gasworks, Blackstoun-road, Paisley

Date of Election.			
1898			||Hislop, Lawrence, Gasworks, Uddingston, Glasgow
1898			Hislop, Robert Findlay, Greenhill House, Paisley
1883			||Hobbs, Bedo, Lamb Brewery, Chiswick, W.
1905			Hobsbaum, Isaac Berkwood, c/o Messrs. Lockett, Bros. & Co., Iquique, Chili, S. America
1901			Hobson, Edwin, Howdendyke, Howden, Yorks.
1884			Hodges, Herbert John, Brewery House, York-buildings, Southampton
1882	Trans.		||Hodgkin, John, F.I.C., 97, Hamlet-gardens-mansions, Ravenscourt Park, W.
1879	Trans.	C. 1883-5, 1907-10	Hodgkinson, William Richard Eaton, Prof., Ph.D. (Würzburg), F.I.C., 89, Shooter's Hill-road, Blackheath, S.E.
1886			||Hodgson, Christopher, 33, Oakdale-road, Netheredge, Sheffield
1873			||Hodgson, Henry Tylston, M.A. (Cantab.), Harpenden, Herts.
1904			Hodgson, Thomas Reginald, M.A. (Cantab.), F.I.C., Count Offices, St. Mary's-gate, Derby
1885			Hogg, Edward Grindle, 1, Southwick-street, Hyde Park-square W.
1883			Hogg, Walter Douglas, M.D. (Paris), 62, Champs Elysées, Paris
1904			Hoit, Alfred Henry, 4, Montgomerie-road, Southsea
1876			Holcroft, Harold, M.A. (Cantab.), Parkdale, Wolverhampton
1908			Holden, George Edward, 23, Durnford-street, Middleton, Manchester
1885			Holgate, Thomas, 61, Calton-road, Dulwich, S.E.
1908			Holland, Frank William Crossley-, 13, Balfour-road, Ilford, E.
1908			Holland, Norman, 4907, Sherbrooke-street-west, Montreal, Canad
1902			Hollingworth, David Vincent, Gas Offices, Bloom-street, Salford
1905			Hollins, Cecil, 22, Gironde-road, Fulham, S.W.
1891			Holloman, Frederick Richard, Liston-street, Plaistow, E.
1886			Holloway, George Thomas, A.R.C.S., F.I.C., 9–13, Emmett-street, Limehouse, E.
1895			Holme, Arthur Edward, M.A. (Oxon.), The Wheelwright Gramma School, Dewsbury
1897	Trans.		Holmes, John, Government Laboratory, Clement's Inn Passage, W.C.
1909			Holmyard, Eric John, 7, Manor-street, Cambridge
1898	Trans.		Holroyd, George William Fraser, M.A. (Oxon.), The Chemical Works, Shoreham, Sussex
1902	Trans.		||Holt, Alfred, jun., M.A. (Cantab.), D.Sc. (Manc.), Crofton, Aigburth, Liverpool
1910			Holt, Fred., B.Sc. (Manc.), 28, Mere-street, Rochdale
1893			Holthouse, Harold Bertram, 12, Melton-grove, West Bridgford, Nottingham

Date of Election.			
898			Homfray, David, B.Sc. (Lond.), F.I.C., 75, Watson-road, Broomhill, Sheffield
878			Hooker, Ayerst Henham, F.I.C., Board of Health, Cairo, Egypt
892	Trans.		Hooker, Samuel Cox, Ph.D. (Munich), 4422, Chestnut-street, Philadelphia, U.S.A.
883			‖Hooper, David, F.I.C., Economic and Art Section, Indian Museum, 1, Sudder-street, Calcutta, India
888		C. 1907-08	‖Hooper, Egbert Grant, F.I.C., 16, Royal-avenue, Sloane-square, S.W.
891			‖Hooper, Ernest Frederick, c/o Messrs. Brotherton & Co., Ltd., Wear Tar Works, South Dock, Sunderland
907	Proc.		Hooton, William Marrs, M.A. (Oxon.) M.Sc. (L'pool), F.I.C., Repton School, Repton, Burton-on-Trent
907			Hope, Geoffrey Dodleston, B.Sc. (Vict. and L'pool), Ph.D. (Halle), c/o Indian Tea Association, Calcutta, India
906			Hopkins, Frederick Gowland, M.A. (Cantab.), M.B., D.Sc., and L.R.C.P. (Lond.), M.R.C.S. (Eng.), F.R.S., F.I.C., 55, St. Andrew's-street, Cambridge
909			Hopkinson, Reginald, B.Sc. (Lond.), Cromwell Lodge, Huntingdon
904			Horn, George Mathieson, Capt., Ivylands, Epping, Essex
908			Hornby, Percy Hulme, c/o The Brentford Gas Co., Southall
894			‖Hornby, Richard, M.A. (Oxon.), Haileybury College, Hertford
911			Horne, William Joseph Chetwynd, c/o Messrs. Cleeve Bros., Lansdowne, Limerick, Ireland
908			Horrobin, Arthur, c/o Bombay, Baroda and Central India Railway Co., Ajmer, Rajputana, India
904			Horrod, George William Thomas, 7A, Lyric-road, Barnes, S.W.
897			Horseman, James Walter, Elstow School, Bedford
892			Horsfall, John, 4, Grange-avenue, Rawtenstall, Manchester
901	Proc.		Horton, Edward, B.Sc. (Lond.), 10, Smith-street, Chelsea, S.W.
909			Hoseason, James Henry, Alderside, Timperley, Altrincham
902			Hosking, Arthur Francis, c/o The Tasmania Gold Mining Co., Ltd., Beaconsfield, Tasmania
886			‖Hoskins, Arthur Percy, F.I.C., Clonlee, Rosetta-park, Belfast
911			Hough, Bernard Grindrod, The Chestnuts, Wardle-road, Sale Manchester
909			Hough, Ralph, 367, Moss-lane-east, Manchester
871			Houlder, William Washington, North Hyde House, Southall
887	Proc.		Houlding, William, B.Sc. (Edin.), 34, Tynemouth-street, Liverpool
882			‖Howard, Alfred Gravely, Burnt House, Chigwell, Essex
901			Howard, Bernard Farmborough, F.I.C., Quantocks, Woodford Green, Essex

Date of Election.			
1870		C. 1875-9 83-5, 98- 1902. V.P. 1886-9, 1903-06	‖Howard, David, J.P., F.I.C., Devon House, Buckhurst Hill, Esse
1887	Trans.		‖Howard, David Lloyd, Little Friday Hill, Chingford, Essex
1889			Howard, George William, Calverley, Tunbridge Wells
1875			Howard, Thomas, F.I.C., 50, Ellington-street, Liverpool-road, N
1903			Howarth, John George, Danes Dyke, Reigate-road, Reigate Surrey
1882			Howe, James Lewis, Prof., M.D. (Louisville), Ph.D. (Göttingen B.A. (Amherst), Washington and Lee University, Lexington Va., U.S.A.
1880			Howell, Reginald, 95A, Southwark-street, S.E.
1905			Howgate, James Henry, B.A. (Lond.), The Grammar School Huntingdon
1876			Howie, William Lamond, 26, Neville-court, Abbey-road, N.W.
1903			Howorth, Franklin Wise, 46, Lincoln's Inn-fields, W.C.
1889			‖Hoyle, Richard Ashworth, Elm-grove, Fairlawn-road, Lytham Lancs.
1889			Hoyles, Henry Richardson, 10, Fore-street, Wellington, Somerse
1907			Hoyten, William James, M.D. (Dun.), M.R.C.S. (Eng.), F.R.C.P. (Lond.), D.P.H. (Vict.), 37, Revelstoke-road, Wimbledon Park S.W.
1907			‖Hubbard, The Hon. Raymond Egerton, B.A. (Oxon.), c/ Messrs. Egerton, Hubbard & Co., St. Petersburg, Russia; an Addington Manor, Winslow, Bucks.
1910			Huck, John, M.A. (Cantab.), The Foundation, St. Bees School St. Bees, Cumberland
1900			Hudson, Edmund Foster, M.A. (Cantab.), Churcher's College Petersfield, Hants.
1899	Trans.		Hübner, Julius, M.Sc. (Manc.), F.I.C., Ash-villa, Cheadle Hulme Cheshire
1911			Hughes, Edwin Burnhope, 3, Burnham-terrace, Richmond, Surre
1903			Hughes, Edwin Reginald, 106, Queen Victoria-street, E.C.
1907			Hughes, Francis Townshend Cunynghame, Major, H.M.'s Assa Office, 47/1, Strand-road, Calcutta, India
1894	Trans.		Hughes, Frank, Turf Club, Cairo, Egypt
1880	Trans.		Hughes, George Henry, 155, Fenchurch-street, E.C.
1910			Hughes, Herbert Hillier, B.Sc. (Lond.), The Grammar School Tottenham, N.
1868			Hughes, John, F.I.C., Analytical Laboratory, 79, Mark-lane, E.C
1906			Hughes, John Gerard, 2, Canute-road, Southampton
1908			Hughes, Joseph Albert, School of Mines, Charters Towers, Queensland, Australia
1896			Hughes, Joshua Arthur, The Square, Abercarn, Mon.

Date of Election.		
885		Hughes, Theophilus Vaughan, A.R.S.M., F.I.C., 4, George-road, Edgbaston, Birmingham
882		Hughes, Thomas, F.I.C., Borough Analyst's Office, 31, Loudoun-square, Cardiff
1908	Trans.	Hull, Thomas Ernest, c/o Mrs. Lemon, 62, Roslyn-terrace, Muiryhall-street, Coatbridge, N.B.
1904		Hulme, John, Ph.D. (Halle), 5, Duke-street, Macclesfield
1907	Trans.	Humphries, Herbert Brooke Perren, B.Sc. (Lond.), A.R.C.S., 117, Avenell-road, Highbury, N.
1883		Humphrys, Norton Henry, Gas Engineer, Salisbury
1883		Hunter, John, F.I.C., 37, Chambers-street, Edinburgh
1885		Hunter, Matthew, M.A. (Oxon.), Rangoon College, Rangoon, Burma
1878		Huntington, Alfred Kirby, Prof., A.R.S.M., F.I.C., Metallurgical Laboratory, King's College, Strand, W.C.
1893	Trans.	Huntly, George Nevill, B.Sc. (Lond.), A.R.C.S., F.I.C., 14A, Finsbury-square, E.C.
1911		Hurst, Reginald, 233, Bellingham-road, Catford, S.E.
1902	Trans.	Hurtley, William Holdsworth, D.Sc. (Lond.), St. Bartholomew's Hospital, E.C.
1861		Huskisson, Henry Owen, F.I.C., Moon-street, Theberton-street, Islington, N.
1907		Hussey, Arthur Vivian, A.C.G.I., 21, Disraeli-road, Putney, S.W.
1900		Hutchin, Henry William, Basset-road, Camborne, Cornwall
1894		Hutchinson, Alfred, M.A. (Cantab.), B.Sc. (Lond.), 3, Windsor-road, Saltburn-by-the-Sea
1890	Trans.	‖Hutchinson, Arthur, M.A. (Cantab.), Ph.D. (Würzburg), Pembroke College, Cambridge
1884		‖Hutchinson, Christopher Clarke, K.C., F.I.C., 13, The Boltons, S. Kensington, S.W.
1908		Hutchinson, Henry Brougham, Ph.D. (Göttingen), Wyver, Spenser-road, Harpenden, Herts.
907		‖Hutchinson, William Doge, B.A. (Oxon.), Ungeverstrasse 11 (I), Munich, Germany
900		‖Ichioka, Tajiro, Prof., Minamihara, Hiratsuka, Japan
888		Idris, Thomas Howell Williams, M.P., 110, Pratt-street, Camden Town, N.W.
907	Trans.	Ingham, Harry, M.Sc. (Vict.), 26, Hamilton-street, Bury, Lancs.
889	Trans.	‖Ingle, Herbert, B.Sc. (Leeds), F.I.C., 18, Crown-terrace, Scarborough
904	Trans.	Inglis, John Kenneth Harold, Prof., D.Sc. (Edin.), M.A., and B.Sc. (N.Z.), University College, Reading

Date of Election.		
1901		Ingram, Beresford, M.A. (Cantab.), Department of Agricultur and Technical Instruction, 17, Ely-place, Dublin
1897	Trans.	Innes, William Ross, D.Sc. (Vict.), Ph.D. (Heidelberg), F.I.C. 9, Red-hill, Edgware, Middlesex
1901		‖Ionides, Stephen Archigenes, B.A. (Oxon.), 136A, Downing street, Denver, Colo., U.S.A.
1908	Trans.	Irvine, James Colquhoun, Prof. D.Sc. (St. Andrews), Ph.D. (Leipzig), Chemical Laboratory, The University, and Edgecliff St. Andrews
1906		‖Irving, Henry Carlyle, B.A. (Oxon.), 2, High-street, Chingford N.E.
1883		‖Irwin, Wilfred, Sunnyside, Papcastle, Cockermouth
1892		‖Isaac, John F. V., M.A. (Oxon.), 38, Silver-crescent, Gunnersbury, W.
1885		Ivatt, Albert, M.A. (Cantab.), The Engadine, Histon, Cambridge
1905		Jack, Maurice Brooks, Bedford Villa, 13, West-view, Highgat Hill, N.
1894		Jackman, Edwin James, 60, Belgrave-road, Ilford, Essex
1883		‖Jackson, Alfred Henrick, Prof., B.Sc. (Vict.), M.Inst.E.E., Th Electrical Engineering School, 349, Collins-street, Melbourne Australia
1894	Trans.	Jackson, David Hamilton, M.A. and B.Sc. (N.Z.), Ph.D (Heidelberg), 95, Abbey-road, N.W.
1882		Jackson, Edward, F.I.C., Raven's Clift, Oxford-road, Moseley Birmingham
1907		Jackson, Ernest Wilfrid, Godrevy, Saltburn-by-the-Sea
1900	Trans.	Jackson, Henry, M.A. (Cantab.), 3, Lygon-road, Edinburgh
1884	Trans.	Jackson, Herbert, Prof., F.I.C., Chemical Laboratory, King' College, Strand, W.C.
1909		Jackson, Robert Ernest, York-villa, Shepherd's-lane, Dartford
1892		‖Jackson, Samuel, A.R.C.S., F.I.C., c/o N. Rhodes, Esq. Carnatic Mill, Perambore Barracks, N. Madras, India
1907		Jackson, Victor George, 21, Frankfurt-road, Herne Hill, S.E.
1902		Jackson, William Brannan, Avalon, Balloch, N.B.
1903		Jackson, William Henry, 73, Church-street, West Hartlepool
1910		Jacobs, Lionel Leslie, P.O. Box 445, Saulte Ste. Marie, Ont. Canada
1887		‖Jadhava, Khasberao Bhagawantrao, M.R.A.C., Mehsana, nea Gujarat, India
1900		Jaffé, Adolf, 8, Leyburn-grove, Shipley, Yorks.
1878	Trans.	Jago, William, Barrister-at-Law, F.I.C., 3, Crown Office-row Temple, E.C.; and 17, Wilbury-avenue, Hove Sussex

Date of Election.			
1904	Trans.		James, Thomas Campbell, M.A. (Cantab.), B.Sc. (Wales), Edward Davies' Chemical Laboratories, University College of Wales, Aberystwyth
1901	Proc.		Jamieson, James Sprunt, F.I.C., Government Laboratory, Durban, Natal, S. Africa
1879	Trans.	C.1882-5 F.S. 85-91 V.P.95-9	†‖Japp, Francis Robert, Prof., M.A. and Hon. LL.D. (St. Andrews), F.R.S., F.I.C., The University, Aberdeen
1910			Jaques, Arthur, B.Sc. (Dun.), A.I.C., 23, St. Oswin's-avenue, Cullercoats, Whitley Bay, Northumberland
1902			Jardin, David Smith, A.R.C.S.I., F.I.C., Lynwood, Dundrum, Co. Dublin
1902			Jardine, Douglas Kennedy, B.Sc. (Vict.), c/o Daily Chronicle Office, Georgetown, Demerara, British Guiana
1882			Jarmay, Gustav, F.I.C., Hartford Lodge, Hartford, Cheshire
1905			Jarrard, William John, B.Sc. (Lond.), A.R.C.S., The University, Sheffield
1898			Jee, Edwin Charles, D.Sc. (Lond.), F.I.C., 39, Pepys-road, New Cross, S.E.
1896	Proc.		Jeffers, Ernest Haynes, 87, Kyrle-road, West-side, Clapham Common, S.W.
1909			Jeffery, John Hugh, 10, Daysbrook-road, Streatham Hill, S.W.
1911			Jenkin, William Alfred, 6, Bella-vista, Rio Tinto, Provincia de Huelva, Spain
1891	Trans.		Jenkins, Henry Charles, A.R.S.M., Assoc. M.Inst.C.E., Balmoral, Green-lane, Redruth, Cornwall
1904			Jenkins, Herbert, 19, Bank-street, Braintree
1892			‖Jenkins, John H. B., Chemical Laboratory, Great Eastern Railway Works, Stratford, E.
1910			Jenkins, Leslie Charles Wood, 31, Eastcombe-avenue, Charlton, Kent
1906	Trans.		Jenkinson, Ernest Arthur, 16, Granville-street, Skipton
1894			Jenks, Robert Leonard, A.C.G.I., F.I.C., Central Excise Laboratory, Kasauli, Punjaub, India
1894			Jennison, Francis Herbert, F.I.C., 11, Upton-avenue, Upton-lane, Forest Gate, E.
1897	Trans.		‖Jerdan, David Smiles, M.A. (Glas.), D.Sc. (Vict.), Ph.D. (Heidelberg), Temora, Colinton, Midlothian
1898			Jessop, Samuel Morton, 19, Burton-street, Wakefield
1879			Jewson, Francis Albert Bowen, F.I.C., 38, Talfourd-road, Peckham-road, S.E.
1901			Johnson, Charles Harold, M.D., C.M., F.R.C.S. and M.R.C.P. (Edin.), Alwyne, Goodall-street, Auburn, Victoria, Australia

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† Longstaff Medallist, 1891.

Date of Election.		
1908		Johnson, Grove, 21, Murphy-street, Richmond, Melbourne, Australia
1897	Trans.	Johnson, Harold, D.Sc. (Brussels), Box 275, Grimsby, Ontario, Canada
1883		Johnson, James Edward, F.I.C., 133, Earlham-grove, Forest Gate, E.
1904		Johnson, John Richard, 10, Copley-park, Streatham Common, S.W.
1897		Johnson, Otis Coe, Prof., 730, Thayer-street, Ann Arbor, Mich., U.S.A.
1906		Johnston, Archibald McArthur, Box 108, Germiston, Transvaal, S. Africa
1904		Johnston, John Haslam, M.Sc. (Vict.), F.I.C., 8, Leopold-road, Wimbledon, S.W.
1896		Johnstone, James, F.I.C., Braehead, Parkhill, Rutherglen
1901	Trans.	Jollyman, Walter Henry, F.I.C., c/o F. W. Jollyman, Esq., Charlton-road, Keynsham, Bristol
1903		Jones, Alfred Owen, c/o Messrs. H. J. Packer & Co., Ltd., Greenbank, Bristol
1907		Jones, Benjamin Owen, Boksburg, Transvaal, S. Africa
1905	Trans.	Jones, Bernard Mouat, B.A. (Oxon.), Prof., Government College, Lahore, India
1898		Jones, Edward, B.Sc. (Lond.), F.I.C., 15, Macaulay-road, Clapham, S.W.
1905		Jones, Edward Towyn, B.Sc. (Wales), A.I.C., 73, Risca-road, Newport, Mon.
1871	Trans.	Jones, Edward William Taylor, F.I.C., The Oaklands, and 10, Victoria-street, Wolverhampton
1873	Trans.	‖Jones, Francis, M.Sc. (Manc.), F.R.S.E., 17, Whalley-road, Whalley Range, Manchester
1894		‖Jones, George Cecil, A.C.G.I., F.I.C., 43, Great Tower-street, E.C.
1893		Jones, Hedley Gordon, F.I.C., 32, Beechhill-road, Eltham, S.E.
1876	Trans.	‖Jones, Henry Chapman, F.I.C., Royal College of Science, S. Kensington, S.W.
1909		Jones, Henry Humphrys, 18, Colquitt-street, Liverpool
1878		Jones, Henry Williams, Westbourne, Gravelly Hill, Birmingham
1900	Trans.	Jones, Humphrey Owen, M.A. (Cantab.), D.Sc. (Lond. and Wales), Clare College, Cambridge
1904		Jones, Horace Francis, Rose Bank, Cambridge-road, Uxbridge
1890		Jones, John Archyll, B.Sc. (Lond.), Reethville, Park-road, West Hartlepool

Date of Election.			
1901			Jones, John Lloyd Thomas, Col., I.M.S., M.B. (Dun.), M.R.C.S. (Eng.), D.P.H. (Cantab.), His Majesty's Assay Office, Bombay, India
1892	Trans.		Jones, Lionel Manfred, B.Sc. (Lond.), Municipal Technical School, Suffolk-street, Birmingham
1906			Jones, Llewelyn Thomas, B.Sc. (Wales), 22, Ashfield-terrace, Bingley, Yorks.
1891			Jones, Moses William, Stone Beck, Brislington, Bristol
1905			Jones, Percy Walter, A.I.C., Technical College, Rockhampton, Queensland, Australia
1901			Jones, Robert Henry, M.Sc. (Vict.), The Harris Institute, Preston
1898			Jones, Thomas Hill-, Invicta Mills, Bow-common-lane, E.
1904			Jones, William App, A.M. (North Carolina), Ph.D. (Baltimore), c/o The Boston Artificial Leather Co., Metropolitan Building, New York City, U.S.A.
1910	Trans.		Jones, William Jacob, B.Sc. (Wales), Queen's-terrace, Llanrwst, Denbighshire
1904	Trans.		Joseph, Alfred Francis, Prof., B.Sc. (Lond.), A.R.C.S., Ceylon Technical College, Colombo, Ceylon
1911			Joseph, Edward Lionel, 96, Victoria-street, S.W.
1910			Joshi, Govind Laxman, c/o H. L. Joshi, Esq., Office of the Inspector of Local Accounts, Nagpur, C.P., India
1893	Trans.	C. 1906 09	Jowett, Hooper Albert Dickinson, D.Sc. (Lond.), 5, Miskin-road, Dartford, Kent
1900			Joyce, Thomas Goode, B.Sc. (Lond.), F.I.C., Lyttleton Preserve and Drysaltery Works, Bromford-lane, West Bromwich
1893			Káká, Sorabji Manekji, Devon Villa, Karachi, Sind, India
1886	Trans.		Kawakita, Michitada, Engineering College, Tokio, Japan
1905	Trans.		Kay, Sydney Alexander, D.Sc. (St. Andrews), Chemistry Department, The University, Edinburgh
1881	Trans.		‖Kay, William Edward, 349, The Cliff, Broughton, Manchester
1907	Trans.		Kaye, John, M.A. and B.Sc. (Glas.), North Britain Glass Works, Perth, N.B.
1886	Trans.	C. 1903-5	‖Keane, Charles Alexander, D.Sc. (Vict.), Ph.D. (Erlangen), F.I.C., The Sir John Cass Technical Institute, Jewry-street, Aldgate, E.C.
1909			Keeble, Horace, Wereham Hall, Stoke Ferry, Norfolk
1882			‖Keen, Austin, Hon. M.A. (Cantab.), Cefn Llys, Bentley-road, Cambridge
1908			Keiller, Patrick Anderson, B.Sc. (St. Andrews), c/o Colombo Commercial Co., Ltd., Colombo, Ceylon

Date of Election.			
1894			‖Kellas, Alexander Mitchell, B.Sc. (Lond.), 2, St. Mark's-square, Regent's Park, N.W.; and Chemical Dept., Middlesex Hospital Medical School, Cleveland-street, W.
1874			Kellner, William, Ph.D. (Göttingen), F.I.C., 135, Victoria-road, Old Charlton, Kent
1867			‖Kemp, David Skinner, 52, Coverdale-road, Shepherd's Bush, W.
1882			‖Kemp, William Joel, F.I.C., Springfield, Elmstead-road, Bexhill-on-Sea
1903			Kemp-Welch, Maurice, B.A. (Cantab.), Parkstone, Weybridge, Surrey
1884			Kendall, George Frederic, B.A. (Cantab.), The Hollies, Stratford-on-Avon
1874			Kendall, James Alfred, F.I.C., Lonesome Chemical Works, Streatham Common, S.W.
1910	Trans.		Kenner, James, Ph.D. (Heidelberg), B.Sc. (Lond.), The University, Sheffield
1896			‖Kennicott, Cass Langdon, Chicago Heights, Illinois, U.S.A.
1903			Kent, Thomas Oliver, 97, Loughborough Park, S.W.
1889			Kenwood, Henry Richard, M.B. and C.M. (Edin.), L.R.C.P. (Lond.), 126, Queen's-road, Finsbury Park, N.
1908	Trans.		Kenyon, Joseph, B.Sc. (Lond.), A.I.C., 25, Irving-place, Blackburn
1903			Kerr, James Stewart, A.R.C.S., F.I.C., 19, Reservoir-road, Edgbaston, Birmingham
1883			Kerry, William Hugh Rubens, The Sycamores, Windermere
1900			Kershaw, James Henry, Corporation Sewage Works, Dalton, Rotherham, Yorks.
1901			Kettle, James David, B.Sc. (Lond.), F.I.C., 3, Huguenot-mansions, East-hill, Wandsworth, S.W.
1902			Kewley, James, M.A. (Cantab.), c/o De Bataafsche Petroleum Maatschappij, Balik Papan, Dutch Borneo
1910			Khan, Prince Mahmood Ali, B.A. (Western Univ.), Zafermanzil, Rampur State, U.P., India
1905			Killby, Leonard Gibbes, B.A. and B.Sc. (Oxon.), 20, Portland-court, Great Portland-street, W.
1900			Kilner, George Washington, M.A. (Lond.), Ormefield, Long-lane, Church-end, Finchley, N.
1884			Kilpatrick, William Stirling, Hawklin, Stuart-drive, Colston, near Bishopbriggs
1903			Kin, Thein, B.A. (Calcutta), Chemical Examiner's Office, Rangoon, Lower Burma, India
1872	Trans.	C. 1887-92	‖Kinch, Edward, Prof., F.I.C., Royal Agricultural College, Cirencester

Date of Election.			
1907			King, Albert Theodore, B.Sc. (Lond.), F.I.C., Church-hill, Horsell, Woking, Surrey
1881	Trans.		King, Alfred John, Rock Bank, Bollington, near Macclesfield
1902			‖King, Frank Eustace, B.Sc. (Lond.), F.I.C., 75, Gracechurch-street, E.C.
1903			King, Frank William George, 15, Almond-road, Tottenham, N.
1897			King, Herbert, M.Sc. (Vict.), F.I.C., 8, Avenue-road, Scarborough
1908			King, James Kirkman, B.A. (Cantab.), Downside College, Stratton-on-the-Fosse, Bath
1876			King, John Falconer, F.I.C., 30, Chambers-street, Edinburgh
1902			King, Sidney Isaac, Hazeldene, Avenue-road, Bexley Heath, Kent
1895			Kingdon, George Holman, M.A. (Oxon.), c/o Messrs. Crosfield, Ltd., Warrington; and Ivy Lodge, Froghall, Warrington
1872	Trans.		‖Kingzett, Charles Thomas, F.I.C., Newlands, St. George's-avenue, Weybridge, Surrey
1891	Trans.	C. 1894-6. V.P. 1908-11	†‖Kipping, Frederic Stanley, Prof., D.Sc. (Lond.), Ph.D. (Munich), F.R.S., F.I.C., University College, Nottingham
1886			Kirby, Herbert Edward, 41, Gordon-square, W.C.
1909			Kirby, Oswald Farquhar, M.A., and B.Sc. (Aberd.), The Leeds Institute, Leeds
1895			‖Kirkaldy, Patrick Henry, Prof., F.I.C., Chemical Department, King's College, W.C.
1903			Kirkby, William, M.Sc. (Manc.), Winster House, Thornfield-road, Heaton Moor, Stockport
1889			Kitchin, John, The Middlesex Hospital, W.C.
1888			‖Knaggs, Alfred Battye, 37, Mannville-terrace, Bradford
1910	Proc.		Knecht, Edmund, Prof., M.Sc. Tech. (Manc.), Ph.D. (Zürich), F.I.C., Beech Mount, Marple, Stockport
1903			Knight, Harley Fancut, 14, Old Queen-street, Westminster, S.W.
1894			Knight, James, M.A. and D.Sc. (Glas.), St. James's Public School, Calton, Glasgow
1896			Knight, John Burnett, Bushwood, Wanstead, Essex
1894			Knight, William Albert, Sexey's Trade School, Bruton, Somerset
1910	Proc.		Knight, William Arthur, M.A. (Cantab.), Elmhurst, Marlborough
1878			Knights, James West, F.I.C., County Laboratory, Cambridge
1879			Knowles, Joshua, c/o J. H. Greenhalgh, Esq., Messrs. S. Knowles & Co., Tottington Mills, Tottington, Bury
1864			Knox, George Walter, B.Sc. (Lond.), 16, Finsbury-circus, E.C.
1873			Koch, Walter Edward, M.A. (Cantab.), P.O. Box 718, El Paso, Texas, U.S.A.
1887	Trans.		Koga, Yoshimasa, The Imperial Mint, Osaka, Japan

† Longstaff Medallist, 1909

Date of Election.		
1904	Trans.	Komppa, Gustav, Prof., Ph.D. (Helsingfors), Polytechnik, Helsingfors, Finland
1885		Koningh, Leonard de, F.I.C., 4, St. Martin's-road, Stockwell, S.W.
1910		Krall, Hans, B.A. (Dub.) Trinity College, Dublin
1892		Krause, Georg, Prof. Dr., Cöthen (Anhalt), Germany
1908	Proc.	Krishnayya, H. V., B.A. (Madras), Government Chemical Laboratory, Mallesvaram, Bangalore, Mysore, India
1910		Kwoh, Sea-Kwain, c/o Ta-Chou Electric Lighting Co., Lily Pond, Chinkiang, China
1859	Trans.	Kynaston, Josiah Wyckliffe, F.I.C., Chemical Laboratory, 3, Oak-terrace, Beech-street, Liverpool
1900		Kynaston, William Charles Robert, 9, Harland-road, Higher Tranmere, Birkenhead
1906		Ladell, William Richard Simpson, F.I.C., Middleburg, Cape Province, S. Africa
1909		Lakhani, Hassum Alidina, M.D. (Brussels), Murud Janjira, Bombay Presidency, India
1893		Lamb, Edmund George, M.A. (Oxon.), M.P., Borden Wood, Liphook, Hants.
1900		Lamb, Morris Charles, The Leathersellers Technical College, 176, Tower Bridge-road, S.E.
1910		Lamb, Samuel, A.R.S.M., May Villa, Birmingham-road, West Bromwich
1892	Trans.	‖Lamb, Thornton Charles, Ph.D. (Heidelberg), c/o Messrs. Brunner, Mond and Co., Crescent Wharf, Silvertown, E.
1910	Trans.	Lambert, Bertram, M.A. (Oxon.) 34, Leckford-road, Oxford
1893		Lambert, Wesley J., Chemical Laboratory, Royal Gun Factory, Woolwich, S.E.
1903	Proc.	Lamplough, Francis Edward Everard, M.A. (Cantab.), Trinity College, 24, Carlyle Road, Cambridge
1877		Lancaster, William James, F.R.C.S., Pine Crest, Barnt Green, Worcs.
1902		Landau, A. Lionel, 20, Highbury-new-park, N.
1900	Trans.	Lander, George Druce, D.Sc. (Lond. and St. Andrews), F.I.C., Royal Veterinary College, Camden Town, N.W.
1897	Trans.	Lang, William Robert, Prof., D.Sc. (Glas.), F.I.C., The University, Toronto, Canada
1899		Lange, Ernest Frederick Stephen, Fairholm, Willow Bank, Fallowfield, Manchester
1885		Langer, Charles, Ph.D. (Zürich), Ynyspenllwch, Clydach, Glam.
1891		‖Langham, Edgar Norman, Rev., M.A. (Cantab.), Rastrick Grammar School, Brighouse

Date of Election.			
1894	Trans.	C. 1904-7	Lapworth, Arthur, D.Sc. (Lond.), F.R.S., F.I.C., The University, Manchester
1908			Larmuth, Lionel Gordon, Enderley, Bramhall, Stockport
1901	Proc.		Larter, Alfred Tabois, B.Sc. (Lond.), 86, Inderwick-road, Stroud Green, N.
1883			Lascelles, Brian Piers, M.A. (Oxon.), Headland, Mount-park, Harrow-on-the-Hill
1901	Trans.		Lattey, Robert Tabor, Royal Naval College, Dartmouth
1906			Lattey, William Tabor, Tarmon, Streatham Park, S.W.
1891	Trans.		‖Lauder, Alexander, D.Sc. (Edin.), Edinburgh and East of Scotland College of Agriculture, 13, George-square, Edinburgh
1886	Trans.		Laurie, Arthur Pillans, Principal, M.A. (Cantab.), D.Sc. (Edin.), F.R.S.E., The Heriot-Watt College, Edinburgh
1910			Lavender, John Herbert, 224, Abbey-road, Barrow-in-Furness
1876			‖Law, Channell, Ilsham Dene, Torquay
1905	Trans.		Law, Herbert Drake, B.Sc. (Lond.), Borough Polytechnic, 103, Borough-road, S.E.
1896			‖Law, Herbert Edward, 636, Pine-street, San Francisco, Cal., U.S.A.
1890	Trans.		‖Law, Robert, F.I.C., The Royal Mint, Melbourne, Australia
1903			Lawrence, Henry William, Johnsonville, Wellington, New Zealand
1900			Laws, Arthur Robert, B.Sc., (Lond.), 90, St. George's-terrace, Newcastle-on-Tyne
1911			Laws, Ernyst Graham, B.A. (Oxon.), 2, Hengist-villas, Southwood-road, Ramsgate
1882			Laws, Joseph Parry, F.I.C., Laurel Bank, Claremont-road, Headingley, Leeds
1890	Trans.		‖Laycock, William Frederick, Ph.D. (Würzburg), 7, Park-street, Dewsbury
1890			Lea, Arthur Sheridan, M.A. and Sc.D. (Cantab.), F.R.S., Sunnyside, Sidcup, Kent
1886			‖Leach, Walter, 21, St. Andrew's-place, Bradford
1902			Leader, George Herbert, Montego Bay Secondary School, Montego Bay, Jamaica
1894	Trans.		‖Lean, Bevan, B.A. and D.Sc. (Lond.), Sidcot School, Winscombe, Somerset
1888			Lease, Frank Edward, Sapong Estate, Fort Birch, British North Borneo
1902			Leather, John Petty, Whittier, Colne-road, Burnley, Lancs.
1891	Trans.		Leather, John Walter, Ph.D. (Freiburg), F.I.C., Agricultural Research Institute, Pusa, Bengal, India
1900			‖Leathes, John Beresford, Prof., M.A., M.B. and B.Ch. (Oxon.), F.R.C.S. (Eng.), F.R.S., The University, Toronto, Canada

Date of Election.			
1889			Ledingham, Laurence Napier, Govandale, Taptonville-crescent, Sheffield
1883			Lee, Herbert Cabry, The Conservative Club, St. James'-street, S.W.
1897	Trans.		Lee, Theophilus Henry, 36, Rua do Ouvidor, Rio de Janeiro, Brazil
1909			Leech, Benjamin, M.A. (Cantab.), Beech Knoll, Macclesfield
1910			Leechman, Alleyne, B.A. (Oxon.), Government Laboratory, George Town, British Guiana
1909			Leedham, Joseph, Chemical Laboratory, H.M. Dockyard, Portsmouth ; and 176, Bromford-lane, West Bromwich
1905			Leek, William Henry, B.A. (Lond.), Elm View, Leigh, Lancs.
1899			Leeming, William Thomas, M.Sc. (Vict.), The Hollins, Hanover-road, Canterbury
1903	Trans.		Lees, Frederic Herbert, 31, Summerhill-road, Dartford, Kent
1889			‖Legg, John Edmund, M.A. (Cantab.), F.I.C., Cae Rhys, Dorchester-road, Weymouth
1901			Lehmann, Adolf Ludwig Ferdinand, B.Sc. (Toronto), Ph.D. (Leipzig), University of Alberta, Strathcona, Alberta, Canada
1903			Leigh, Arthur Graham, jun., Chorcliff House, Chorley, Lancs.
1889			Leigh, Cecil, F.I.C., Birmingham Metal and Munitions Co., Ltd., Adderley Park Rolling Mills, Birmingham
1904			Le May, Percy Kent, 6, Lothair-villas, Hatfield, Herts.
1891			Lennox, Robert Nicol, Morvah, Hartington-road, Chiswick, S.W.
1899			Leon, Arthur Alexander, Chadhurst, Hermitage-lane, Hampstead Heath, N.W.
1906	Trans.		Le Rossignol, Robert, B.Sc. (Lond.), A.I.C., Prinz Regentenstrasse 108, Berlin, W., Germany
1904			Lessing, Rudolf, Ph.D. (Munich), Southampton House, 317, High Holborn, W.C.
1902			Lessner, Charles Blüthner, Carril, Spain
1895	Trans.	C. 1907-11	‖Le Sueur, Henry Rondel, D.Sc. (Lond.), F.I.C., St. Thomas's Hospital, S.E.
1899			Lett, Stephen Joshua, Panjaboengan, via Padang, Sumatra (West Coast), Dutch East Indies
1879			Letts, Edmund Albert, Prof., Hon. D.Sc. (R.U.I.), Ph.D. (Göttingen), F.I.C., Queen's College, Belfast
1903			Levy, Henry Wolff, 423B, Little Collins-street, Melbourne, Australia
1909	Trans.		Levy, Leonard Angelo, M.A. (Cantab.), B.Sc. (Lond.), F.I.C., 60, Priory-road, West Hampstead, N.W.
1888	Trans.		Lewes, Vivian Byam, Prof., F.I.C., 30, Croom's-hill, Greenwich, S.E.

Date of Election.			
1907			Lewis, Carl, Lewis'-buildings, President-street, Germiston, Transvaal, S. Africa
1899	Trans.		Lewis, Edward Watkin, Hollycroft, Loughton, Essex
1901			Lewis, Ernest Alfred, 310, Dudley-road, Birmingham
1910			Lewis, Frederick Charles, School of Pathology, Yates Laboratories, The University, Liverpool
1910	Trans.		Lewis, Samuel Judd, Ph.D. (Tübingen), B.Sc. (Lond.), F.I.C., 122, Newington Causeway, S.E.
1909	Proc.		Lewis, William Cudmore McCullagh, M.A. (R.U.I), D.Sc. (L'pool), University College, Gower-street, W.C.
1894	Trans.		Lewis, William Henry, M.A. (Oxon.), F.I.C., 27, St. Leonard's-road, Exeter
1869	Trans.		‖Lewis, William James, Prof., M.A. (Oxon. and Cantab.), F.R.S., New Museums, Cambridge
1888	Trans.	C. 1902-03	‖Lewkowitsch, Julius, M.A. and Ph.D. (Breslau), F.I.C., 71, Priory-road, West Hampstead, N.W.
1878			‖Lichtenstein, Theodore David, F.I.C., Chemical Works, Silvertown, E.
1896			Lidgey, Cecil Rudolf, 45, Cresswell-road, East Twickenham
1900			Liebmann, Adolf, M.A. and Ph.D. (Bonn), The Whim, Weybridge
1903			Linday, John Howard, c/o The Nivalbo Co., Mapperley, Nottingham
1901			‖Linde, Harold Theodor Granville van der, c/o Continental Rubber Co., 111, Broadway, New York City, U.S.A.
1908			Lindley, Arthur Stanley, Laboratory, Prince-building, Medows-street, Bombay, India
1899			Lindsey, Robert William, 14, Hilldrop-road, Camden-road, N.
1911			Linenbröker, Henry Edmund, 100, Harrow-road, Paddington, W.
1886	Trans.	C. 1911-	Ling, Arthur Robert, F.I.C., 74, Great Tower-street, E.C.
1911			Ling, Herbert James, Hankow Dispensary, Hankow, China.
1899			Linstead, Edward Flatman, 15, Station-avenue, Winchmore Hill, N.
1902			Liotard, Ernest, 2, Rue de France, Nice, France
1905			Lister, Joseph, B.Sc. (Lond.), Ph.D. (Leipzig), A.R.C.S., The Technical Institute, Sheerness
1853	Trans.	V.P. 1883-7, 1898-1901.	‖Liveing, George Downing, Emeritus Prof., M.A. (Cantab.), Hon. Sc.D. (Cantab. & Dub.), F.R.S., F.I.C., The Pightle, Cambridge
1872	Trans.	V.P. 1910-	‖Liversidge, Archibald, Emeritus Prof. M.A. (Cantab.), Hon. LL.D. (Glas.), A.R.S.M., F.R.S., F.I.C., Hornton Cottage, Hornton-street, Kensington, W.
1903			Livesey, Charles Edwin Leonard, B.Sc. (Vict.), Stonyhurst College, Blackburn, Lancs.
1883			Livingston, William John, F.I.C., 26, Osbaldeston-road, Stoke Newington Common, N.
1909			Livsey, Harry, 26, Thorpe-street, Old Trafford, Manchester

Date of Election.		
1880		‖Lloyd, Alfred, The Dome, Bognor, Sussex
1876	Trans.	Lloyd, Frederick James, F.I.C., Muscovy House, 6, Trinity-square, E.C.
1905		Lloyd, George Moss, M.A. (Vict.), M.Sc. (L'pool), National Correspondence College, S. Kensington, S.W.
1907		Lloyd, Percival George, Kelvinside, Lower Ham-road, Kingston-on-Thames
1896		Lloyd, Thomas Henry, F.I.C., c/o Messrs. Quibell Bros., Ltd., Newark-on-Trent
1900		Lockhart, Thomas Lamb, Glencairn Main Reef Gold Mining Co., Ltd., P.O. Box 191, Germiston, Transvaal, S. Africa
1902		Logan, Thomas Stratford, The Colony, Ewell, Surrey
1884		London, John Edward, M.D. (Dun.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), 62, Main-street, Georgetown, Demerara, W. Indies
1910		‖Long, Frank Stevenson, B.Sc. (Lond.), 80, Tylney-road, Forest Gate, E.
1910		Longman, Charles Herbert Bell, A.R.C.S., Tientsin Anglo-Chinese College, Tientsin, N. China, via Siberia
1872		‖Longstaff, George Blundell, M.A. and M.D. (Oxon.), F.R.C.P., (Lond.), M.R.C.S. (Eng.), Highlands, Putney Heath, S.W.
1904		Longstaff, James Patrick, D.Sc. (Edin.), 17, Fettes-row, Edinburgh
1873	Proc.	‖Loram, Herbert Yabsley, F.I.C., 49, Buxton-road, Chingford, Essex
1878	Trans.	‖Louis, David Alexander, F.I.C., 123, Pall Mall, S.W.
1882		Love, Edward Gurley, Ph.D. (Columbia), 80, East 55th-street, New York City, U.S.A.
1882		‖Lovibond, Thomas Watson, F.I.C., West Jesmond House, Newcastle-on-Tyne
1884		‖Low, Charles William, M.B. (Dun.), M.R.C.S. (Eng.), L.R.C.P. and D.P.H. (Lond.), Stricklands, Stowmarket, Suffolk
1910		Low, Kenneth Stewart, A.R.S.M., 10, Paul-street, Finsbury, E.C.
1910	Trans.	‖Lowe, Clement Ward, F.I.C., Thorneyholme, Knutsford
1904	Trans.	Lowe, Frank Harold, M.Sc. (Vict.), South-Western Polytechnic, Manresa-road, Chelsea, S.W.
1878		‖Lowe, Walter Bezant, M.A. (Cantab.), Cae Carw, Llanfairfechan, Carnarvonshire
1876		Lowe, William Foulkes, A.R.S.M., F.I.C., 9, Hough-green, Chester
1898	Trans.	‖Lowry, Thomas Martin, D.Sc. (Lond.), 130, Horseferry-road, Westminster, S.W.
1901		Lowson, William, B.Sc. (Lond. and Leeds), F.I.C., The University, Leeds
1899		Lucas, Alfred, F.I.C., Survey Department, Finance Ministry, Giza, Egypt
1905		Lucas, Edward William, F.I.C., Oxford Works, Tower Bridge-road, S.E.

Date of Election.		
1902		Lucas, Harry, The South of England College of Pharmacy, 186, Clapham-road, S.W.
1911		Lucas, Thomas Riley, 3, Cantonments, Vizianagram, Madras, India
1905		Luck, Alfred Courtenay, Laboratorio de Polvoras, Ministerio de Marina, Darsena Norte, Buenos Ayres, Argentine, S. America
1910		Lucking, Hubert Leslie, Ph.D. (Heidelberg), A.I.C., Tiffenden, Woodstock-road, Golders Green, N.W.
1902	Trans.	Ludlam, Ernest Bowman, D.Sc. (L'pool), M.Sc. (Vict.), Clifton College, Bristol
1877	Trans.	‖Luff, Arthur Pearson, M.D., B.Sc., F.R.C.P. and L.S.A. (Lond.), M.R.C.S. (Eng.), D.P.H. (Glas.), F.I.C., 9, Queen Anne-street, Cavendish-square, W.
1890	Trans.	Lumsden, John Scott, D.Sc. (St. Andrews), Ph.D. (Munich), 9, Rosewood-terrace, West Park, Dundee
1907		Lunan, George, 50, Garscube-terrace, Murrayfield, Edinburgh
1909		Lundholm, Carl Olof, F.I.C., 2, Eton-avenue, Hampstead, N.W.
1872	Trans.	‖Lupton, Sydney, 102, Park-street, Grosvenor-square, W.
1893	Trans.	Luxmoore, Charles Mann, D.Sc. (Lond.), F.I.C., 19, Disraeli-gardens, Putney, S.W.
1899		Luxton, Thomas, B.A. and B.Sc. (Lond.), 116, North Boulevard, Hull
1908		Lyell, Henry Robert, A.I.C., Redcott, Dacres-road, Sydenham, S.E.
1908		Lynch, Gerald Roche, 160, Holland-park-avenue, W.
1874		Lyon, John George, F.I.C., The Aire Tar Works, Knottingley, Yorks.
1886	Trans.	Lyons, Albert Brown, A.M. (Williams Coll.), M.D. (Mich.), 102, Algee-avenue, Detroit, Mich., U.S.A.
1888		Maben, Thomas, 20, Great Pulteney-street, W.
1896		Macadam, Herbert Edwin, Odam's Wharf, Victoria Docks, E.
1888		‖Macadam, Stevenson John Charles George, F.I.C., Analytical Laboratory, 55, York-place, Edinburgh
1899		McAlley, James, c/o Messrs. M. Cockburn & Co., Ltd., Gowanbank Iron Works, Falkirk, N.B.
1903		Macara, Thomas, F.I.C., c/o Messrs. Lipton's, Ltd., Rouel-road, Bermondsey, S.E.
1887		‖McArthur, John, F.R.S.E., 262, Trinity-road, Wandsworth Common, S.W.
1890		‖MacArthur, John Stewart, 74, York-street, Glasgow
1911	Trans.	McBain, James William, M.A. (Toronto), Ph.D. (Heidelberg), The University, and 71, Cotham-brow, Bristol.
1910		McBeath, John William, Kimberley Mine Hospital, Kimberley, S. Africa

Date of Election.			
1888			McBretney, Edmund George, F.I.C., Newfield, Park-avenue, Castleford
1900			McCall, William, 13, Dargarvel-avenue, Dumbreck, Glasgow
1902			MacCallum, Douglas Archibald, Central-chambers, 93, Hope-street, Glasgow
1905			McCleary, William, 61, Station-rd., Pendlebury, near Manchester
1899			McClumpha, Robert, 372, Westgate-road, Newcastle-on-Tyne
1906	Trans.		McCombie, Hamilton, M.A. (Aberd.), B.Sc. (Lond.), Ph.D. (Strassburg), A.R.C.S., F.I.C., The University, Edgbaston, Birmingham
1907	Trans.		McConnan, James, D.Sc. (L'pool), M.Sc. (Vict.), Ph.D. (Jena), Frigorifico, Campana, F.C.R., Argentine, S. America
1904			McCourt, Cyril Douglas, A.C.G.I., 13, Rosslyn, Ellers-road, Leeds
1899			McCracken, James, Ballantrae, Roxburgh-circus, Cardonald, N.B.
1896	Trans.		McCrae, John, jun., Ph.D. (Heidelberg), F.I.C., Government Laboratories, P.O. Box 1080, Johannesburg, S. Africa
1899			McCreath, William Dunlop, Quantock Vale Cider Co., Ltd., North Petherton, Bridgwater
1890			‖McCubbin, William Alexander, F.I.C., The Flax-yard, Little Neston, Chester
1897			MacCulloch, Charles, Auckland Club, Auckland, New Zealand
1894			McCutcheon, James, Meniehaus, Woodend-drive, Jordanhill, Glasgow
1903			Macdonald, David Baird, 82, Hinckley-road, Leicester
1901			Macdonald, F. G., Durban Roodeport Gold Mining Co., Ltd., P.O. Box 111, Roodeport, Transvaal, S. Africa
1894	Trans.		MacDonald, George William, M.Sc. (Melbourne), Geddes House, Burch-road, Gravesend
1906			Macdonald, Thomas, c/o Indian Fisheries Co., Cochin, Southern India
1891			MacDonald, William, A.R.C.S., A.R.S.M., F.I.C., Assistant Postal Secretary, Peking, China
1904			McDougall, Arthur Thomas, B.A. (Lond.), Beaufort Cottage, Wellington-road, Bow, E.
1906			McDowall, John, c/o H. Monson, Esq., Sabaieh, Upper Egypt
1906			Mace, William Ethrington, Box 662, General Post Office, Montreal, Canada
1886			MacEwan, Peter, 64, Southwood-lane, Highgate, N.
1898			McEwen, Antholl Francis, 709, Torrey-building, Duluth, Minnesota, U.S.A.
1895			MacFarlane, Alexander, Loch Sloy, Polefield, Blackley, Manchester

Date of Election.			
1891			Macfie, Robert Andrew Scott, M.A. (Cantab.), B.Sc. (Edin.), 34, Moorfields, Liverpool
1910			MacGeorge, David Jackson, 13, Strand-road, Rangoon, Burma
1909			McGillvray, John Esson, M.A. (Edin.), Henry Smith School, Hartlepool
1895			McGlashan, John, Cawnpore Sugar Works, Cawnpore, India
1887	Trans.		McGowan, George, Ph.D. (Leipzig), F.I.C., 21, Montpelier-road, Ealing, W.
1908			MacGregor, Gregor, M.A. and B.Sc. (Glas.), Sinclairtownbank, Kirkcaldy, Fife, N.B.
1893			McGregory, Joseph Frank, Prof., Colgate University, Hamilton, N. Y., U.S.A.
1906			McIntosh, David, 88, Rothbury-terrace, Heaton, Newcastle-on-Tyne.
1890			Macintyre, Alfred Edgar, Ph.D. (Jena), The Chemical Laboratory, Dominion Arsena Quebec, Canada
1905			MacKechnie, Rober Drysdale, Minas de Rio Tinto, Provincia de Huelva, Spain.
1901	Trans.	C. 1910-	‖McKenzie, Alexander, M.A. and D.Sc. (St. Andrews), Ph.D. (Berlin), Birkbeck College, Bream's Buildings, Chancery-lane, E.C.
1897	Trans.		Mackenzie, John Edwin, D.Sc. (Edin.), Ph.D. (Strassburg), 2, Ramsay-gardens, Edinburgh
1902			Mackenzie, John Ross, Worcester Brewery, Worcester
1899			‖Mackenzie, Thomas, 4, Church-street, Inverness
1900			Mackenzie, Thomas Ebenezer, c/o The West Mexican Mines, Ltd., Guadalupe y Calvo, Chihuahua, Mexico.
1893			McKerrow, Charles Alexander, 56, Ramillies-road, Bedford Park, W.
1892			McKerrow, William James, D.Sc. (Tübingen), F.I.C., 97, Coldharbour-road, Redland, Bristol
1897	Proc.		Maclaurin, James Scott, D.Sc. (N.Z.), Wellington, New Zealand
1868	Trans.	C. 1871-4, 80-4, 95-9. V.P. 1887-90, 1901-04	‖McLeod, Herbert, Prof., Hon. LL.D. (St. Andrews), F.R.S., 37, Montague-road, Richmond, Surrey
899			McLeod, James, F.I.C., Gas Works, Greenock, N.B.
903			MacMahon, Frederick William, Netherhay, The Common, Warlingham, Whyteleafe, Surrey
879			‖Macmillan, James Laker, 9, Wool-Exchange, MacQuarrie-place, Sydney, N.S.W.
889	Trans.		‖McMurtry, George Cannon, A.R.S.M., A.R.C.S., Templemore, Richmond, Nelson, New Zealand
880			Macnab, William, F.I.C., 10, Cromwell-crescent, S.W.

Date of Election.			
1885	Trans.		‖Macnair, Duncan Scott, Ph.D. (Würzburg), B.Sc. (Lond.), 67 Braid-avenue, Edinburgh
1910			McNish, Malcolm, Shortsands, St. Neots
1899			Main, Hugh, B.Sc. (Lond.), Almondale, Buckingham-road South Woodford, N.E.
1900			Mair, William, 37, Morningside-drive, Edinburgh
1902	Trans.		Maitland, William, D.Sc. (Aberd.), Heriott-Watt College Edinburgh
1910			Majima, Rikō, Science College, Imperial University, Tokio Japan
1906			Majumdar, Tarak Nath, 37, Lower Chitpore-road, Calcutta India
1894			Makin, Charles James Shaw, F.I.C., Thorn Bank, Leamington
1885	Trans.		‖Mallet, Frederic Richard, F.I.C., 20, King's-avenue, Ealing, W.
1897			Mallinson, Willie Lee, Gawthorp-green, Kirkheaton, near Huddersfield
1904			Mander, Alfred, Belle Vue House, Malvern
1903			Mander, Percy George, B.Sc. (Lond.), The Grammar School, Doncaster
1903			Mann, Ernest William, Lyndale, Northfield-road, King's Norton, Birmingham
1903			Mann, John Christopher, 33, Nicholls-street, West Bromwich
1902			Mann, William, B.Sc. (Lond.), 84, Inchmery-road, Catford, S.E.
1896			Manners, Hugh, M.A. and B.Sc. (Glas.), Academy House, Airdrie, N.B.
1908			Mansfield, Herbert, B.Sc. (Lond.), A.I.C., 70, Stapleton-hall-road, Stroud Green, N.
1897			Mansford, Charles John Jodrell, B.A. (Lond.), The Grammar School, Dartford, Kent
1910			Marcan, Alexander, A.I.C., Royal Mint, Bangkok, Siam
1895			‖Marchant, Robert Charles, Salisbury-road, Andover
1905	Trans.		Marle, Ernest Robert, B.Sc. (Lond.), A.R.C.S., Hartley University College, Southampton
1907	Trans.		Marsden, Herbert, B.Sc. (Manc.), Bramford, Ipswich
1895			Marsden, Prosper Henry, The Royal Infirmary, Liverpool
1883	Trans.	C. 1902-7	‖Marsh, James Ernest, M.A. (Oxon.), F.R.S., University Museum, Oxford
1895	Trans.		Marshall, Arthur, A.C.G.I., F.I.C., Chief Chemical Examiner, Naina Tal, India
1890	Trans.	C. 1911-	‖Marshall, Hugh, Prof., D.Sc. (Edin.), F.R.S., University College, Dundee
1896			Marshall, Percy Sykes, 49–65, Grant-street, Melbourne, Australia

Date of Election.		
1891		Marshall, Reginald Tom, Kingscote, Upper Lenham-road, Sutton, Surrey.
1887		‖Marshall, William, F.I.C., Laboratory, Ladybrook-road, Cheadle Hulme, Stockport
1897		Martin, Charles Henry, 40, Bolton-road, Pendleton, Salford
1902		Martin, Francis, 3, York-terrace, Eglinton-road, Plumstead, S.E.
1905		Martin, Francis Grimshaw, B.Sc. (Lond. and Birm.), A.I.C., Haslemere, Spa-lane, Hinckley
1906		Martin, Frederick James, c/o The Raub Australian Gold Mining Co., Ltd., Raub, Pahang, Federated Malay States
1907		Martin, Gerald Hargrave, 3A, Church-road, Upper Norwood, S.E.
1906		Martin, George Frederick Wesley, 14, Castle-park, Lancaster
1898	Trans.	‖Martin, George Herbert, M.A. (Oxon.), The Grammar School, Bradford
1885		‖Martin, Gerald Ward, Lieut.-Col., 8, Petersham-terrace, Gloucester-road, S.W.
1901		Martin, Nicholas Henry, Ravenswood, Low Fell, Gateshead-on-Tyne
1910		Martin, William Ernest, 111, Bellevue-road, Berea, Durban, Natal, S. Africa
1909		Martin, William George, B.Sc. (Wales), Fellside, Hexham
1902		Martindale, William Harrison, Ph.D. (Marburg), 10, New Cavendish-street, W.
1871		‖Martineau, George, 21, Mincing-lane, E.C.; and Gomshall Lodge, Gomshall, Surrey
1887		‖Martineau, Sydney, Streatham-grove, Norwood, S.E.
1898		Mascarenhas, John Charles, Ph.D. (Coimbra), 27–28, King William-street, E.C.
1905		Mason, Arthur Walter, B.Sc. (Lond.), Norvic, Windsor-gardens, North Shields
1890		Mason, Francis Herbert, 3868, Florida-street, San Diego, Cal., U.S.A.
1882	Trans.	Masson, David Orme, Prof., M.A. and D.Sc. (Edin.), F.R.S., The University, Melbourne, Australia
1910	Trans.	Masson, James Irvine Orme, M.Sc. (Melb.), 2, Chester-street, Edinburgh
1897		Masters, Edward, Rock Mount, 186, Hinckley-road, Leicester
1873		‖Masters, William, St. Erme, The Hall-road, Cheltenham
1906		Mastin, John, M.A., D.Sc., Ph.D., Woodleigh House, Totley Brook, near Sheffield
1909		Matchett, Andrew Sneddon, 13, Bute-gardens, Cathcart, N.B.
.904		Mathews, Harold Joseph Clarke, Massey's Burnley Brewery, Ltd., Burnley, Lancs.

Date of Election.			
1902			Mathieson, Robert, J.P., Rill Bank, Innerleithen, Peeblesshire
1876	Trans.		‖Matthews, Charles George, F.I.C., Abendberg, 31, Stapenhill-road, Burton-on-Trent
1907			Matthews, Charles Pask, B.Sc. (Lond.), F.I.C., Tiffin's Boys' School, Kingston-on-Thames
1880	Trans.	C. 1906-09	‖Matthews, Francis Edward, Ph.D. (Göttingen), F.I.C., Ash Lawn, The Glebe, Blackheath, S.E.
1884			‖Matthey, Edward, Col., C.B., A.R.S.M., 31a, Weymouth-street, W.
1870		C. 1877-9	Matthey, George, Assoc.Inst.C.E., F.R.S., 78, Hatton-garden, E.C.
1893			‖Mawer, William Frederick, 27, Cathles-road, Balham, S.W.
1865			‖Maxwell, Theodore, B.A. and M.D. (Cantab.), F.R.C.S. (Edin.), B.Sc. (Lond.), 29, Woolwich Common, S.E.
1909	Trans.		May, Percy, B.Sc. (Lond.), 126, Cazenove-road, Stamford Hill, N.
1909			May, Rowland Josiah, Brockville, Sache-road, Upper Clapton, N.E.
1908			Maywald, Frederick John, 89, Pine-street, New York City, U.S.A.
1892			Meacham, Charles Stephen, c/o Messrs. Ohlsson's Cape Breweries, Ltd., Newlands, Cape Town, S. Africa
1908			Meade, Alwyne Harcourt, Cedar House, St. Neots
1898			Meads, Charles James, 21, Woodstock-road, Bedford Park, W.
1910	Trans.		Meanwell, Charles Wright, F.I.C., 15, Woodlands-crescent, Muswell Hill, N.
1904			Mears, Francis D'Oyley, jun., c/o The Campbell Ehrenfried Co., Ltd., Auckland, New Zealand
1901	Trans.		Mees, Charles Edward Kenneth, D.Sc. (Lond.), 76, Canterbury-road, Croydon
1908			Meggitt, Alfred Ash, B.Sc. (Lond.), Government of Eastern Bengal and Assam, Dacca, Eastern Bengal, India
1896			Meggitt, Loxley, F.I.C., c/o C.W.S., Ltd., Wheatsheaf Works, Alexandria, Sydney, N.S.W.
1871	Trans.	C. 1883-7, 90-91- F.S.1891-1902 V.P. 1902–05 P.1905-7	‖Meldola, Raphael, Prof., Hon. D.Sc. (Oxon.), F.R.S., F.I.C., Hon. LL.D. (St. Andrews), Finsbury Technical College, Leonard-street, E.C.; and 6, Brunswick-square, W.C.
1905	Trans.		Meldrum, Andrew Norman, D.Sc. (Aberd.), Portland-park, Hamilton, N.B.
1894			Melland, Godfrey, M.Sc. (Vict.), A.R.S.M., F.I.C., Chemical Department, The Polytechnic, Woolwich, S.E.
1908			Melling, Samuel Ernest, F.I.C., The Cliff, Higher Broughton, Manchester
1902	Trans.		Mellor, Joseph William, D.Sc. (N.Z.), The Villas, Stoke-on-Trent

Date of Election.			
1875			‖Melmore, Pattinson Banks, North How, Maryport
1902			Mence, George Augustus Henry, B.Sc. (Lond.), The Grammar School, Lincoln
1900	Proc.		Menzies, Alan Wilfrid Cranbrook, M.A. and B.Sc. (Edin.), Ph.D. (Chicago), Kent Chemical Laboratory, The University, Chicago, Ill., U.S.A.
1908			Menzies, Frederick Norton Kay, M.D., B.S. and F.R.C.P. (Edin.), D.P.H. (R.C.P.S. Lond.), 79, Davies-street, Berkeley-square, W.
1889			Mercer, Thomas, F.I.C., Devonshire Club, Eastbourne
1901			Meredith, William, 63, Albion-place, Ulverston, Lancs.
1896			Merrett, William Henry, A.R.S.M., F.I.C., Hatherley, Grosvenor-road, Wallington, Surrey
1908			Merrick, Arnold, B.Sc. (Dun.), 66, Rothbury-terrace, Newcastle-on-Tyne
1891			Merrils, Frederick Johnson, Haxworth-chambers, 25, Figtree-lane, Sheffield
1911	Trans.		Merriman, Richard William, M.A. (Cantab.), 244, Victoria-park-road, South Hackney, N.E.
1897			Merson, George Fowlie, c/o Messrs. J. F. Macfarlan & Co., Abbey-hill Chemical Works, Edinburgh
1910	Trans.		Merton, Thomas Ralph, B.A. (Oxon.), 18, Grosvenor-street, W.
1876	Trans.	C. 1884-8, 1897-1901 V.P. 1906-9	‖Messel, Rudolph, Ph.D. (Tübingen), 147, Victoria-street, Westminster, S.W.
1911			Messervy, Roney Forshaw, 73, Blenheim-crescent, Ladbroke-grove, W.
1909			Metzger, Floyd Jay, Columbia University, New York City, U.S.A.
1900			Meyer, Hans, Ph.D., 1, Salmgasse, Prague, Bohemia
1904			Middleditch, Bernard, B.A. (Cantab.), Woodcroft, Harrow-on-the-Hill
1906			Middleton, Alexander Edmund, Government Laboratory, Clement's Inn-passage, Strand, W.C.
1888	Trans.	V.P. 1901-04	‖Miers, Henry Alexander, Principal, M.A. and D.Sc. (Oxon.), Hon. LL.D. (Sheffield), F.R.S., 23, Wetherby-gardens, S.W.
1908			Miles, William Herbert, c/o Messrs. H. A. Fowler & Co., 167, Vauxhall-road, Liverpool
1908			Millar, Charles James, c/o Messrs Turner, Morrison & Co., 6, Lyons-range, Calcutta, India
1892	Trans.		Millar, James Hill, D.Sc. (Birm.), F.I.C., Chief Chemist's Laboratory, St. James's Gate Brewery, Dublin
1891			‖Millard, Edgar James, 35–42, Charlotte-street, Great Eastern-street, E.C.
1905			Millen, John Dunlop, Mount Bischoff Mine, Waratah, Tasmania

Date of Election.			
1880	Trans.		‖Miller, Alexander Kenneth, Ph.D. (Würzburg), F.I.C., Kilvert's-buildings, Withy-grove, Manchester
1901			Miller, Edward Holl, c/o Anglo Australian Milk Co., Clydebank, Sale, Victoria, Australia
1889	Trans.		Miller, James Bruce, A.I.C., Rubislaw Den North, Aberdeen
1887			Miller, John Albert, M.Sc. (Illinois), Ph.D. (Berlin), 44 & 45, Lewis Block, Buffalo, N.Y., U.S.A.
1911			Miller, John Watterson, M.D. (Vict. and L'pool.), B.Ch. (Vict.), D.P.H. (Cantab.), Lynwood, Cantilupe-street, Hereford
1885	Trans.		‖Miller, Norman Harry John, Ph.D. (Würzburg), F.I.C., Harpenden, Herts.
1898			Miller, William Lash, B.A. (Toronto), Ph.D. (Munich), 50, St. Alban-street, Toronto, Canada
1893	Trans.		‖Mills, Charles, F.I.C., P.O. Box 112, Kroonstad, S. Africa
1862	Trans.	C. 1868-72, 75-6, 80-4, 1903-06	‖Mills, Edmund James, Prof., D.Sc. (Lond.), LL.D. (Glas.), F.R.S., F.I.C., 64, Twyford-avenue, West Acton, W.
1906			Mills, Herbert Arthur, 3, Croxted-road, West Dulwich, S.E.
1898	Trans.		Mills, William Hobson, M.A. (Cantab.), Sc.D. (Tübingen), The Northern Polytechnic Institute, Holloway, N.
1905	Trans.		Mills, William Sloan, M.A., D.Sc. and B.E. (R.U.I.), Chemical Dept., The Polytechnic, Woolwich, S.E.
1885			‖Milne, Alexander, Lieut.-Col. I.M.S., M.A., M.B. and M.Ch. (Aberd.), Morkew, Cults, Aberdeenshire
1887			Mingaye, John Charles Henderson, F.I.C., Department of Mines, Assay Branch, Sydney, N.S.W.
1898			‖Mitchell, Albert Henry, B.Sc. (Lond.), F.I.C., Borough Analyst's Laboratory, Hensleigh-road, Tiverton
1910	Trans.		Mitchell, Alec Duncan, B.Sc. (Lond.), 52, Montalt-road, Woodford Green
1907	Trans.		Mitchell, Herbert Victor, c/o The British Burma Petroleum Co., Ltd., 8–12, Spark-street, Rangoon, Burma
1910			Mitra, Dhirendranath, B.A. (Shilpur), 89/2, Musjeed, Bari-street, Calcutta, India
1905			‖Modi, Edalji Manekji, D.Sc. (N. Carolina), LL.D. (Tennessee), Litt.D. (Providence, Ohio), Meaher-buildings, Tardeo, Bombay, India
1899			Mohr, Bernard, Ph.D. (Heidelberg), 69A, Parliament-hill, Hampstead, N.W.
1901	Trans.		Moir, James, M.A. and D.Sc. (Aberd.), Chemical Laboratory, Mines Department, Plein-street, Johannesburg, S. Africa
1893			Mole, Herbert Bloome, St. Anne's, Morgan-road, Reading
1902			Molesworth, Francis Hylton, Jersey-road, Artarmon, Sydney, N.S.W.

Date of Election.			
1899			Molson, John Cavendish, M.D. (Chicago), L.R.C.P. (Lond.), 17, Vernon-terrace, Brighton
1899			Mond, Emile Schweich, 22, Hyde-park-square, W.
1892			Mond, Robert Ludwig, M.A. (Cantab.), F.R.S.E., The Poplars, 20, Avenue-road, Regent's Park, N.W.
1879			‖Mondy, Edmund Felix, A.R.S.M., Dacca, 96, Huron-road, Balham, S.W.
1903	Trans.		Monier-Williams, Gordon Wickham, M.A. (Oxon.), Ph.D. (Freiburg), F.I.C., Chessington, Surbiton, B.O., Surrey
1904			Montgomery, Jack Percival, Ph.D. (Virginia), A.M. (Clarksville), Agricultural College, Starkville, Miss., U.S.A.
1887	Trans.	C. 1899-1900 1905-8	‖Moody, Gerald Tattersall, D.Sc. (Lond.), F.I.C., Lorne House, North Dulwich, S.E.
1897			Moon, Philip George Gregory, Hillcroft, Alexandra-road, Upper Parkstone, Dorset
1892			‖Moor, Cresacre George, M.A. (Cantab.), F.I.C., Savoy House, 115, Strand, W.C.
1903			Moore, Alfred Ernest, B.A. and B.Sc. (Lond.), Escuela Normal Regional, Corrientes, Argentine, S. America
1903			Moore, Arthur, 128, Felbrigge-road, Goodmayes, Essex
1905	Trans.		Moore, Charles Watson, M.Sc. (Vict.), Ph.D. (Munich), c/o Messrs. J. Crosfield & Sons, Ltd., General Laboratory, Warrington
1891			Moore, Frederick Herbert, 39, Lime-street, E.C.
1910			Moore, Harold, B.Sc. Tech. (Manc.), 84, Kalashnikoff-quay, St. Petersburg, Russia
1907			Moore, John Edward Langford, Walton Cottage, Loughboro'-park, S.W.
1902			Moore, Thomas Henry, c/o F. R. Wilson, Esq., Enfield, Wingrove-road, Newcastle-on-Tyne
1904	Trans.		Moore, Tom Sidney, M.A. (Oxon.), B.Sc. (Lond.), Magdalen College, Oxford
1911	Trans.		Moore, Walter Roman, B.Sc. (Lond.), A.R.C.S., Sylva, Sorbie-road, Saltcoats, N.B.
1908			Morewood, Capel Darcy, Ferndale, Frodingham, Doncaster
1895			Morgan, David James, M.A., M.D. and B.C. (Cantab.), D.P.H. (Lond.), Medical Officer of Health, Swansea
1897			Morgan, Frederick Filmer de, 57, Woodberry-crescent, Muswell Hill, N.
1898	Trans.	C. 1909-10 S. 1910-	‖Morgan, Gilbert Thomas, D.Sc. (Lond.), A.R.C.S., F.I.C., Royal College of Science, South Kensington, S.W.; and 19, Fawcett-street, Redcliffe-gardens, S.W.
1908			Morgan, Howard Houlston, B.Sc. (Lond.), A.R.C.S., University College, Auckland, New Zealand

Date of Election.			
1888			‖Morgan, John James, F.I.C., 14, Borough-road, Jarrow-on-Tyne
1900			Morgan, John Livingston Rutgers, Prof., A.M. and Ph.D. (Leipzig), B.Sc. (Rutgers College), Columbia University, New York, U.S.A.
1880	Trans.		Moritz, Edward Ralph, Ph.D. (Göttingen), F.I.C., 45, Great Tower-street, E.C.
1879	Trans.	C.1887-90, 96-1900	‖Morley, Henry Forster, M.A. and D.Sc. (Lond.), F.I.C., 5, Lyndhurst-road, South Hampstead, N.W.
1909			Morley, William Norton, B.Sc. (Lond.), 325, Brownhill-road, Catford, S.E.
1895	Trans.		‖Morrell, Robert Selby, M.A. (Cantab.), Ph.D. (Würzburg), c/o Messrs. Mander Bros., Wolverhampton; and Tor Lodge, Tettenhall Wood, Wolverhampton
1892			Morris, Albert, B.A. and B.Sc. (Lond.), Fern Bank, Ashton-under-Lyne
1890			Morris, Arthur Higgs, 13, Park-street, Bolton
1900			Morris, Edgar Ford, M.A. (Oxon.), c/o Cornbrook Chemical Co., Ltd., Newbridge Mills, Stockport, Cheshire
1905			Morris, Eric Haydn, Box 1302, General Post Office, Johannesburg, S. Africa
1891			Morris, Joseph, Ph.D., Fern Bank, 8, Boardman-street, Eccles, Manchester
1905			Mortimer, Alfred, B.A. (Oxon.), Seafield Park College, near Fareham
1872			Morton, Edward Handfield, 88, Wigmore-street, W.
1893			Morton, Frederick, Chemical Works, Milnsbridge, Huddersfield
1890	Trans.		Mosenthal, Henry de, F.I.C., 220, Winchester-house, Old Broad-street, E.C.
1896			Moss, Francis Ambrose, Greenbushes, Western Australia
1871			‖Moss, Richard Jackson, F.I.C., St. Aubyns, Ballybrack, Co. Dublin
1898			Moss, William Edward, 2, Windermere-terrace, Princes-park, Liverpool
1886			‖Moul, Frank, F.I.C., 5, Blakesley-avenue, Ealing, W.
1911			‖Moullin, Oswald Mansell-, B.A. (Cantab.), 69, Wimpole-street, W.
1884			‖Moyle, Robert Edward, M.A. (Oxon.), Heightley, Chudleigh, S. Devon
1902			Müller, Christian, 6, Baronsfield-road, East Twickenham, Middlesex
1859	Trans.	C.1863-6 F.S. 69-85 P. 85-7	‖Müller, Hugo, Ph.D. (Göttingen), LL.D. (St. Andrews), Hon. D.Sc., (Manc.) F.R.S., 13, Park-square East, Regent's Park, N.W.
1909			Müller, John, B.A. (Cape of Good Hope), Government Analytical Laboratory, Grahamstown, Cape Colony, S. Africa

Date Election			
1909	Trans.		Müller, Robert, Ph.D. (Zürich), 9, Schanzengraben, Zürich, Switzerland
1871	Trans.	C. 1890-4	‖Muir, Matthew Moncrieff Pattison, M.A. (Cantab.), Hillcrest, Farnham
1870			‖Muirhead, Alexander, D.Sc. (Lond.), F.R.S., The Lodge, Shortlands, Kent
1906			Mukerjee, Ram Chandra, Prof., B.A. (Allahabad), Maharaja's College, Jaipur, Rajputana, India
1907			Mummery, Charles Samuel, Central Technical College, South Kensington, S.W.
1906			Mummery, William Rest, F.I.C., c/o Establecimientos Argentinos de Bovril, Ltd., Santa Elena, Entre Rios, Argentine, S. America
1893	Proc.		Munby, Alan Edward, M.A. (Cantab.), 44, Downshire-hill, Hampstead, N.W.
1902			Mundey, Alfred Holley, 14, Wrottesley-road, Plumstead, Kent
1876	Trans.		‖Munro, John May Herbert, D.Sc. (Lond.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), F.I.C., 12, Grosvenor-place, Bath
1888			Munroe, Charles Edward, Prof., George Washington University, Washington, D.C., U.S.A.
1900			Munton, Frederick Thomas, The Oak House, Winsford, Cheshire
1910			Murch, Douglas Wilshin, 74, Stafford-street, Wednesbury
1907			Murgatroyd, Louis, 1, Carlton-drive, Heaton, Bradford
1901			Murphy, Albert John, 28, Great George-street, Leeds
1904			Murray, Benjamin Lindley, A.M. (Columbia), B.S. (Mich.), c/o Messrs. Merck & Co., Manufacturing Chemists, Rahway, N.J., U.S.A.
1906			Murray, Thomas Jenkins, M.Sc. (Birm.), Ph.D. (Leipzig , Municipal Technical School, Wolverhampton
1890	Trans.		‖Murray, Thomas Smith, D.Sc. (Edin.),1, Nelson-street, Dundee
1869			‖Muspratt, Edmund Knowles, Hon. LL.D. (L'pool), F.I.C., Seaforth Hall, near Liverpool
1873			‖Muspratt, Sidney Knowles, 9, Church-street, Flint, N. Wales
1896			Muter, Alexander Henry Mitchell, F.I.C., Laboratory, 325, Kennington-road, S.E.; and The Châtelet, Horley, Surrey
1870	Trans.		‖Muter, John, Ph.D. (Rostock), F.I.C., Laboratory, 325, Kennington-road, S.E.; and The Châtelet, Horley, Surrey
1910	Trans.		Myers, James Eckersley, B.Sc. (Manc.), Acresfield, Gatley, Cheshire
1892	Trans.		Myers, William Shields, D.Sc. (N.J.), 71, Nassau-street, New York City, U.S.A.
1887			Nagel, David Henry, M.A. (Oxon.), Trinity College, Oxford
1910			Nair, Valliyil Govindan, B.A. (Madras), M.Sc. Tech. (Manc.), School of Technology, Manchester

Date of Election.		
1903		Nairne, Urban Orlando Scotchburn, 7, Hawthorne-terrace Ripple-road, Barking, Essex
1874		‖Napier, Arthur Sampson, Prof., B.Sc. (Oxon.), c/o Herren Mayer and Müller, 2, Prinz Louis Ferdinandstrasse, Berlin
1893		Napier, John Watson, Corporation Gas Works, Alloa, N.B.
1909		Napier, Thomas, c/o The Cassel Cyanide Co., Ltd., Maryhill, Glasgow
1900	Trans.	Napper, Sidney Scrivener, A.C.G.I., A.I.C., c/o Messrs. S Courtauld and Co., Ltd., Foleshill-road, Coventry
1910		Narbeth, Benjamin Mason, B.Sc. (Wales), Technical Institute, Russell-street, Durban, Natal, S. Africa
1898		Nash, Leonard Myddelton, F.I.C., 3, Princess-road, Finsbury Park, N.
1900		Naylor, Ernest Brooks, M.Sc. (Vict.), A.I.C., Eversleigh, Gathurst, Wigan
1906		Naylor, George, 21, Hampstead-hill-gardens, Hampstead, N.W.
1891		Naylor, William, 3, Garstang-road, Fulwood-park, Preston
1878	Trans.	Naylor, William Arthur Harrison, F.I.C., The British Drug House, Ltd., 22–30, Graham-street, City-road, N.
1910		Neal, George William, B.Sc. (Lond.), 8, Little Park-gardens, Enfield, Middlesex
1899	Trans.	Neale, Harry Ainley, Mission Junction, British Columbia
1908		Neech, Herbert Richard, 20, Colegrave-street, Lincoln
1910		Needs, Francis Edwin, 7, Effingham-road, St. Andrew's-Park, Bristol
1898		Neilson, Alexander MacGillivray, Umbilo Post Office, via Durban, Natal, S. Africa
1908	Trans.	Neogi, Punchãnan, Prof., M.A. (Calcutta), Rajshahi College, Rajshahi, Eastern Bengal and Assam, India
1901		Neumann, Edgar David Maurice, M.A. (Oxon.), Ph.D. (Göttingen), A.I.C., 7 & 8, Idol-lane, E.C.
1871	Trans.	‖Nevill, Edmund Neville, F.R.S., F.I.C., Government Laboratory, Durban, Natal, S. Africa
1890	Trans.	Neville, Francis Henry, M.A. (Cantab.), F.R.S., La Verna, Letchworth, Hitchin
1905	Trans.	Neville, Henry Allen Dugdale, B.Sc. (Lond.), F.I.C., 11, de Freville-avenue, Chesterton-road, Cambridge
1892		‖Newall, John Fenton, 33, George-street, Manchester
1885		‖Newbolt, Francis George, M.A. (Oxon.) Balliol College Laboratory, Oxford
1901		Newbould, Herbert Simpson, 15, York-road, Heaton Moor, near Stockport
1864		‖Newlands, Benjamin Edward Reina, F.I.C., 2, St. Dunstan's-hill, E.C.

Date of Election.		
1891		‖Newlands, William Peter Reina, 10, Cricklade-avenue, Streatham Hill, S.W.
1910	Trans.	Newman, Sidney Herbert, B.Sc. (Lond.), Springfield Brewery, Wolverhampton
1889		Newsholme, George Thomas Wilkinson, 27, High-street, Sheffield
1894	Trans.	Newth, George Samuel, F.I.C., Royal College of Science, South Kensington, S.W. ; and The Sheiling, Godstone, Surrey
1895		Newton, Charles Butterworth, M.Inst.C.E., Town Hall, Hull
1911		Newton, Leonard Owen, St. Elba, Napoleon-road, St. Margaret's, Twickenham
1883		Newton, William, Ph.D. (Zürich), F.I.C., Dyne House, 24, Gordon-street, W.C.
1899	Trans.	Nicholls, William Walter Scott, B.Sc. (Lond.), c/o Mrs. Tyrrell, 8, Foxwell-street, Brockley, S.E.
1870	Trans.	‖Nicholson, Edward, Brigade Surgeon, Lieut.-Col., M.R.C.S. (Eng.), L.S.A. (Lond.), D.P.H. (Cantab.), F.I.C., 111, Avenue de Neuilly, Neuilly-sur-Seine, Paris, France
1910		Nicholson, Philip Brady, Doncaster-road, Thrybergh, Rotherham
1889		Nickels, Wallace Christopher, 41, Cheapside, E.C.
1892		Nickolls, John Bate, The Exchange, Malvern
1883	Trans.	Nicol, William Walker James, M.A. and D.Sc. (Edin.), F.I.C., 15, Blacket-place, Edinburgh
1900		Nightingale, Thomas Marginson, B.Sc. (Vict.), 375, Bridgman-street, Bolton
1898		Nightscales, Thomas Arthur, 642, Holderness-road, Hull
1894		Nixon, Alfred, 7, Oak-road, Sale, Manchester
1869		Noble, Sir Andrew, Bart., K.C.B., D.C.L. (Dun.), F.R.S., Jesmond Dene House, Newcastle-on-Tyne
1908		Norman, Cyril Lawrence, 247A, Cavendish-road, Balham, S.W.
1903	Trans.	Norman, George Marshall, B.Sc. (Lond.), A.R.C.S., A.I.C., 120, Walmersley-road, Bury, Lancs.
1889		Norman, John Thomas, 23, Leadenhall-street, E.C.
1908		Normand, Alexander Robert, M.A. and B.Sc. (Edin.), Wilson College, Bombay, India
1861		Norrington, Frederick, 5, Downfield-road, Clifton, Bristol
1892		Norris, Charles James, 31, Airedale-avenue, Chiswick, W.
1909	Trans.	Norris, Roland Victor, M.Sc. (Manc.), 16, Roseneath-road, Clapham Common, S.W.
1897	Trans.	North, Barker, 22, Horton-park-avenue, Bradford
1892		Northing, John, The Murrough, Wicklow
1878		‖Norton, Thomas Herbert, Prof., Ph.D. (Heidelberg), D.Sc. (Hamilton), c/o The American Consulate, Theaterstrasse, 14, Chemnitz, Saxony, Germany

Date of Election.			
1901			Nunn, Arthur William, 57, Crouch-street, Colchester
1907	Trans.		Nuttall, Walter Harold, F.I.C., Trafoi, Albert-road, Watfor
1904			Oakden, William Edward, c/o The American Optical Co., Southbridge, Mass., U.S.A.
1910			Oakley, Robert O'Field, 54, Sydney-road, Hornsey, N.
1893	Trans.		Oates, William Henry, Townhead, Dore, Sheffield
1907			Oberländer, Otto, Ph.D. (Heidelberg), 29, Queen-street, E.C.
1903			O'Brien, Frederick, M.Sc. (L'pool.), Lynwood, Bishopsworth, Bristol
1902			O'Connor, Sinnott Valentine, Spawell House, Wexford
1890			Oddy, Robert Walter, F.I.C., Waterhouse, Toad-lane, Rochdale
1873			‖Odling, Walter, F.I.C., c/o Messrs. Bass and Co., Burton-on-Tren
1848	Trans.	S. 1856-69 V.P. 1869-73 P. 1873-5	Odling, William, Prof., M.A. (Oxon.), M.B. and F.R.C.P (Lond.), Hon. Ph.D. (Leyden), F.R.S., F.I.C., 15, Norham gardens, Oxford
1905			‖O'Farrelly, Alfons, M.A. (R.U.I.), 65a, Upper Leeson-street, Dubli
1908			‖Oke, Alfred William, B.A. and LL.M. (Cantab.), 32, Denmark-villas, Hove, Sussex
1909			Okell, Frederick Leigh, F.I.C., c/o Straits Trading Co., Ltd., Singapore, Straits Settlements
1908			Okell, Stanley Allen Warrington, 27, King's-road, Ealing, W.
1901			Oldershaw, William, Strelley, Nottingham
1904			Oldfield, Laurel Cecil Francis, 5, Pump-court, Temple, E.C.
1906			Oliver, Edgar Gale, M.A. (Cantab.), Chigwell School, Essex
1889			O'Mahony, Daniel John, Municipal-buildings, Cork
1901			Oram, Frank, Market-place, Romsey
1890	Trans.		Ormandy, William Reginald, D.Sc., 53a, Barton-arcade, Manchester
1872			‖Ormerod, Joseph Arderne, M.D. (Oxon.), M.R.C.S. (Eng.), F.R.C.P. (Lond.), The Medical Committee Room, St. Bartholomew's Hospital, E.C.
1887			‖Ormiston, Archibald Reid, Braeholm, Helensburgh; and 213, St. Vincent-street, Glasgow
1893			Orr, Alexander, Norwich-chambers, 35A, Bligh-street, Sydney, N.S.W.
1881			Orr, John Bryson, Crossacres, Much Woolton, Liverpool
1897	Trans.		‖Orton, Kennedy Joseph Previté, Prof., M.A. (Cantab.), Ph.D. (Heidelberg), F.I.C., Llwyn Eithin, and University College o North Wales, Bangor
1881	Trans.		O'Shea, Lucius Trant, M.Sc. (Sheffield), B.Sc. (Lond.), The University, Sheffield

Date of Election.		
1887		Ostersetzer, Julius, F.I.C., c/o Messrs. W. and H. M. Goulding, Manure Manufacturers, North Wall, Dublin
1883	Trans.	O'Sullivan, James, F.I.C., High Bank, Burton-on-Trent
1899		O'Sullivan, John, 1649, Barclay-street, Vancouver City, British Columbia
1887		‖O'Sullivan, Patrick Thomas, M.D. and B.Ch. (R.U.I.), 20, South Mall, Cork
1891		Ough, Lewis, Fernleigh, St. James's-road, Leicester
1888		Overbeck, Otto Christoph Joseph Gerhard Ludwig, Chantry House, Great Grimsby
1887		‖Overend, Frederick Lawrence, B.A. (Oxon.), Lyndhurst, Leigh-road, Walsall
1911		Owen, Idris Larkby, 101, Floyer-road, Small Heath, Birmingham
1909		Owen, Robert Cecil, B.Sc. (Lond.), 89, Foregate-street, Chester
1906		Oxland, Charles Harold, B.Sc. (Manc.), The Grammar School, Wellingborough
1911	Trans.	Page, Harold James, B.Sc. (Lond.), 163, West-road, Westcliff-on-Sea, B.O., Southend-on-Sea
1909		Painter, Frederick Hubert, B.Sc. (Lond.), 29, Talbot-road, Winton, Bournemouth
1884		‖Pallister, John William, B.Sc. (Lond.), 107, Waverley-road, Bradford
1910		Palmer, Gilbert, B.Sc. (Lond.), 17, Wansbeck-gardens, West Hartlepool
1888		Palmer, Henry John, Buddlebrook, Bridestowe, Devon
1899		Palmer, Thomas Henry, c/o Broken Hill Junction North Silver Mining Co., P.O. Box 98, Broken Hill, N.S.W.
1902		Panisset, Sydney Glyde Stephen, Lyme Villa, Cherry Hinton, Cambridge
1899	Trans.	Panting, Laurence Christopher, M.A., M.D. and B.Ch. (Oxon.), 45, Lemon-street, Truro
1910		Paris, Edward Talbot, 15, Montpellier-villas, Cheltenham
1898		Parker, Alfred James, c/o Mrs. Wintere, Papatoitoi, Auckland, New Zealand
1897		Parker, Charles Henry, 106, Tettenhall-road, Wolverhampton
1882		Parker, Joseph Richard, Avondale, 129, Kyverdale-road, Stoke Newington, N.
1894	Trans.	Parker, Matthew Archibald, Prof., B.Sc. (Glas.), University of Manitoba, Winnipeg, Canada
1882		‖Parker, Robert Henry, Ravenscar, Orchard-road, Blackheath, S.E.
1901		Parkes, Albert Edward, F.I.C., Chemical Laboratory, 43, Whitehorse-street, Stepney, E.
1906		‖Parkin, John, M.A. (Cantab.), Blaithwaite, Carlisle

Date of Election.			
1865	Trans.		‖Parkinson, James, Queen's-chambers, Pirie-street, Adelaid S. Australia
1893			‖Parrish, Samuel, B.Sc. (Lond.), 80, Grange-avenue, Chapeltow road, Leeds
1892			Parry, Ernest John, B.Sc. (Lond.), F.I.C., Thanet House, 56 Great-Dover-street, S.E.
1903	Trans.		Parry, William, B.Sc. (Lond.), Incewood, Waterloo-park, Live pool
1911			Pastfield, John Lawrence Robinson, B.A. (Oxon.), Olivedal St. Thomas, Exeter
1911			Partington, Edward, Oakdene, Sedgley-park, Manchester
1870			Patchett, Isaac, F.I.C., 59, Holyrood-terrace, Carlinghow, Batle
1894	Trans.		Paterson, David, F.R.S.E., Lea Bank, Rosslyn, Midlothia
1910			Paterson, John Hamilton, M.Sc. (Dundee), Carmyle. Wellingto street, Grimsby
1885	Trans.		Patterson, George, F.I.C., 20, Madrid-road, Castelnau, Barne S.W.
1896			Patterson, Joseph William, 20, South-road, West Hartlepoo Durham
1870	Trans.		Patterson, Thomas Law, F.I.C., Maybank, Finnart-stree Greenock
1904	Trans.		Patterson, Thomas Stewart, D.Sc. (Lond. and Glas.), Ph. (Heidelberg), Chemical Department, The University, Glasgow
1863	Trans.	{ V.P. 1891-4 }	Pattinson, John, F.I.C., 10, Dean-street, Newcastle-on-Tyne
1868	Trans.		‖Paul, Benjamin Horatio, Ph.D. (Giessen), Parkside, Kingsto Vale, Putney, S.W.
1885	Trans.		Paul, Lewis Gordon, Ph.D. (Tübingen), F.I.C., Market Hal chambers, King-street, Huddersfield
1901			Pay, Walter Herbert, Government Explosives Office, P.O. Bo 943, Durban, Natal, S. Africa
1896			Payne, Arthur, c/o Messrs. Mawson and Swan, Moseley-street Newcastle-on-Tyne
1893			Payne, George Frederick, M.D. (Atlanta), 60, Armstrong-street Atlanta, Georgia, U.S.A.
1899	Trans.		Peachey, Stanley John, M.Sc. (Manc.), School of Technology Sackville-street, Manchester
1901			Peacock, Arthur, B.Sc. (Vict.), The Brebner Schools, Bloemfon tein, S. Africa
1900			Pearce, Ernest Vivian, c/o Transvaal Consolidated Lands, Ltd. Groenfontein Mine, Potgietersrust, Transvaal, S. Africa
1874			Pearce, William, M.P., Chemical Works, Bow Common, E.
1908			Pearson, George Edward, c/o Messrs. Burroughs, Wellcome & Co. Snow Hill Buildings, E.C.

Date of Election			
1908			Pearson, John William, B.A. (Cantab.), 19, Palmyra-square, Warrington
1894	Trans.		Pearson, William Henry, Suffolk House, Cannon-street, E.C.
1902			Peck, John Wicliffe, 13, Springwell-avenue, Harlesden, N.W.
1911	Trans.		Peddle, Cyril James, M.Sc. (Sheffield), 146, Barnsley-road, Cudworth, Barnsley
1894			Peden, John, Chemical Laboratory, 11, Duff-street, Greenock
1870	Trans.	V.P. 1907-10	‖Pedler, Sir Alexander, Prof., C.I.E., F.R.S., F.I.C., 28, Stanhope-gardens, Queen's Gate, S.W.
1904			Pell, Alfred, 44, Cumballa-hill, Bombay, India
1886	Proc.		Pendlebury, William Henry, M.A. (Oxon.), Woodford House, Mountfield, Shrewsbury
1905			Penn, Francis Richard, B.Sc. (Lond), A.R.C.S., 11, Crawshaw-avenue, Pudsey, Leeds
1870			Penney, Mulgrave Daniel, 11, High-street, Hull
1910			Pennington, Alfred John, Oakley, Fallowfield, Manchester
1895			Pennington, William Henry, Westgate, Longley-road, Worsley
1905			Pennycuick, Thomas, B.Sc. (Lond.), 6, Darley-drive, West Derby, Liverpool
1886			Pentecost, Stephen James, Lenton Works, Nottingham.
1911			Percival, George Arncliffe, 34, Cartwright-gardens, W.C.
1884	Trans.	C. 1906-10	Perkin, Arthur George, Prof., F.R.S., F.I.C., The University, and Grosvenor Lodge, Grosvenor-road, Leeds
1891	Trans.		‖Perkin, Frederick Mollwo, Ph.D. (Würzburg), F.I.C., 199, Piccadilly, W.
1884	Trans.	C. 1891-5 V.P. 1906-9	†Perkin, William Henry, Prof., Ph.D. (Würzburg), Hon. Sc.D. (Cantab.), Hon. LL.D. (Edin. and St. Andrews), F.R.S., F.I.C., Fairview, Wilbraham-road, Fallowfield, Manchester
1906			Perkins, William Hughes, B.Sc. (Manc.), The University, Leeds
1890	Trans.		‖Perman, Edgar Philip, D.Sc. (Lond.), University College, Cardiff
1905			Perrott, Bert, Bryn Clydach, Neath Abbey, Neath
1908			Perry, Frank, 69, Dudley-road, Tipton
1900			Pettigrew, Robert, 44, Mosley-street, Manchester
1902	Trans.		Phelps, John, M.A. (Oxon.), The Royal Mint, E.; and Newcroft, Egmont-road, Sutton, Surrey
1881			Philip, Arnold, B.Sc. (Lond.), A.R.S.M., F.I.C., Chemical Laboratory, H.M. Dockyard, Portsmouth
1897	Trans.	C. 1910-	Philip, James Charles, M.A. and D.Sc. (Aberd.), Ph.D. (Göttingen), Royal College of Science, S. Kensington, S.W.
1904			Phillips, George Frederick Tyler, B.Sc. (Lond.), University College, Southampton
1897	Trans.		Phillips, Harry Edward William, M.A. and B.Sc. (Oxon.), Church House, Summertown, Oxford

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Date of Election.			
1882			Phillips, Henry Harcourt, Lynwood, Turton, Lancs.
1902	Trans.		Phillips, Percy Philip, Ph.D. (Göttingen), Thomason Engineering College, Rurki, U.P., India
1908			Phillips, Thomas Richard, 5, Enmore-road, Putney, S.W.
1905			Phipson, Percy Barker, c/o Messrs. J. Staples and Co., Ltd. Wellington, New Zealand
1909	Trans.		Pickard, Joseph Allen, B.Sc. (Lond.), A.R.C.S., Irtish, Upton road, Bexley Heath, Kent
1897	Trans.		‖Pickard, Robert Howson, D.Sc. (Lond.), Ph.D. (Munich), B.Sc (Birm.), F.I.C., Municipal Technical School, Blackburn
1891			Pickering, Michael Samuel, B.Sc. (Lond.), 38, Price-street Burslem
1878	Trans.	C.1886-7, 89-93, 1901-04.	‖Pickering, Spencer Percival Umfreville, M.A. (Oxon.), F.R.S. F.I.C., Harpenden, Herts.
1906	Trans.		Pickles, Samuel Shrowder, D.Sc. (Vict.), Imperial Institute, S.W
1890	Trans.		‖Picton, Harold, B.Sc. (Lond.), Clacton College, Clacton-on-Sea
1909	Trans.		Picton, Norman, B.Sc. (Wales), Ph.D. (Leipzig), 31, South Beach-avenue, Ardrossan, N.B.
1894			Pike, Ernest Brooke, Northern Outfall, Beckton, Woolwich, E.
1903			Pike, Henry George, 8, Eastbourne-avenue, Claremont-road, Bath
1874	Trans.		‖Pike, William Herbert, Prof., Ph.D. (Göttingen), Sandhills Salcombe, Devon
1883			‖Pilley, John J., Ph.D., 167, Camberwell-grove, S.E.
1896			Pilley, Thomas William, 33, Grove-hill-road, Denmark Hill S.E.
1904			Pinchbeck, Gerald, Sunnyside, c/o Messrs. Oldfield, Pattinson and Co., New Bridge-street, Manchester
1909			Ping, Francis Hugh, A.R.C.S., 14, Selsdon-road, Wanstead, N.E
1889			Ping, William, 14, Selsdon-road, Wanstead, N.E.
1908			Pingriff, George Neville, B.A. (Cantab.), The Grammar School Market Bosworth, Nuneaton
1889			‖Pingstone, George Arthur, P.O. Box 445, Bulawayo, S. Africa
1904			Pinkerton, David John, Dalzell Steel and Iron Works, Motherwell, N.B.
1908			Pinnock, Douglas Robert, A.C.G.I., 93, Danforth-avenue, Greenville, Jersey City, U.S.A.
1881			Pisani, Orestes Victoriano, 56, Cavendish-road, Balham, S.W.
1903	Trans.		Pitt, Arthur Ernest, Broad View, Chigwell-road, South Woodford, N.E.
1903			Pitt, Harold Russell, 21, Parkview-terrace, Welling
1911			Pitt, Leonard Ison, B.Sc. (Lond.), The School, Stamford
1882			‖Pitt, Theophilus, Highleigh, Sidlesham, Chichester
1899			Pittuck, Frederick Williams, 19, Stratford-grove, Heaton, Newcastle-on-Tyne

Date of Election.			
1899			Pizey, James Henry, A.R.C.S., F.I.C., 45, South-road, Smethwick, Birmingham
1893			Platt, Charles, M.D., Ph.D., 3612, Baring-street, Philadelphia, U.S.A.
1911			Plews, Frank Henry, 28, Gellatly-road, St. Catherine's Park, S.E.
1899	Trans.		‖Plimmer, Robert Henry Aders, D.Sc. (Lond.), 3, Hall-road, N.W.
1907			Pochin, Harold, M.A. (Cantab.), The Grammar School, Wolverhampton.
1888			Pollard, Frederick Ernest, F.I.C., 14, Old Hall-street, Hertford
1898	Trans.		Pollard, William, M.A. (Cantab.), D.Sc. (Tübingen), F.I.C., The Museum, Jermyn-street, S.W.
1903			‖Pollard, William Branch, B.A. (Cantab.), Laboratory-buildings, Public-works-gardens, Cairo, Egypt
1902			Pollitt, George Paton, B.Sc. (Vict.), Ph.D. (Bâle), Winnington, Northwich, Cheshire
1901			Pollitt, James Charles Tomlin, 7, Grosvenor-road, Handsworth, Birmingham
1896			Pollitt, Robert Barnabas, F.I.C., c/o J. Manning Prentice, Esq., Solicitor, Stowmarket
1894	Trans.		‖Pollok, James Holms, D.Sc. (Glas.), Royal College of Science, Stephen's-green, Dublin
1903			Pond, George Gilbert, Prof., M.A. and Ph.D. (Amherst), State College, Pennsylvania, U.S.A.
1890			Pond, James Alexander, Auckland, New Zealand
1899			Ponthieu, Georges, 1736, Hutchison-street, Montreal, Canada
1909	Trans.		Pope, Frank George, 28, Alcester-crescent, Upper Clapton, N.E.
1898	Trans.		Pope, Thomas Henry, B.Sc. (Birm.), A.C.G.I., F.I.C., Brewing School, The University, Birmingham
1891	Trans.	C. 1900-2 V.P. 1911-	†‖Pope, William Jackson, Prof., M.A. (Cantab.), M.Sc. (Manc.), F.R.S., F.C.G.I., F.I.C., Hon. LL.D. (St. Andrews), Chemical Laboratories, The University, and Holmesdale, Brooklands-avenue, Cambridge
1906			Porritt, Benjamin Dawson, B.Sc. (Lond.), F.I.C., c/o Miss Laing, 62, Queen-street, Edinburgh
1903			Porter, Robert James, B.Sc. (Lond.), 11, Arlington-street, Hull
1884	Proc.		‖Porter, Thomas Cunningham, M.A. and D.Sc. (Oxon.), Upton-park, Slough; and Eton College, Windsor
1904			‖Porter, Thomas Linton Daniel, B.Sc. (Lond.), 162, Coventry-road, Ilford, E.
1910			Posford, Benjamin Ashwell, Wood Dene, Kippington, Sevenoaks
1883			Potter, Charles Edward, c/o Messrs. Tate and Sons, Love-lane Sugar Refinery, Liverpool

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Date of Election.			
1896			Potts, Henry William, Hawkesbury Agricultural Colleg Richmond, N.S.W.
1895			Powell, Harry James, 125, Thurlow-park-road, Dulwich, S.E.
1884			‖Power, Francis Reginald, The Royal Mint, Melbourne, Australia
1896	Trans.		Power, Frederick Belding, Ph.D. (Strassburg), Hon. LL. (Wisconsin), 6, King-street, Snow-hill, E.C.
1908			Power, George O'Brien, Assistant Opium Agent, Basti, B.N. Railway, India
1910			Prasad, Hari, B.A. (Punjab), B.Sc. (Manc.), Saleem-building Lahore, India
1904	Trans.		Prentice, Bertram, Ph.D. (Munich), D.Sc. (Edin.), Roy Technical Institute, Salford
1910			Preston, Knowles, Laburnum Villa, Camden-avenue, Feltha Middlesex
1902			Přibram, Richard, Hofrat Prof. Dr., Horlgasse 9, Vienna IX., Austri
1882			‖Price, Arthur Faraday, 2503, Broadway, San Francisco, Cal U.S.A.
1899			Price, Robert Coleman, Prof., The Miller School, P.O., Albemar Co., Va., U.S.A.
1901	Trans.		Price, Thomas Slater, D.Sc. (Lond. and Birm.), Ph.D. (Leipzig F.I.C., Chemical Department, Municipal Technical Colleg Suffolk-street, Birmingham
1889			‖Priestley, Charles William, B.Sc. (Lond.), A.R.C.S., Richmon Lodge, Torquay
1871	Trans.		‖Procter, Henry Richardson, Prof., Hon. M.Sc. (Leeds), F.I.C., Th University, Leeds; and Rowangarth, Ben Rhydding, viâ Leed
1889	Trans.		Proctor, Charles, F.I.C., 118, Grosvenor-road, Westminster, S.
1909			Proud, Charles, 12, Chancellor-road, Southend-on-Sea
1896	Proc.		Proude, James, c/o John Turner, Esq., Providence Soap and O Works, Halifax
1897			Pullar, Herbert Spindler, Pullar's Dye Works, Perth, N.B.
1882			‖Pullar, Rufus Daniell, Brahan, Perth, N.B.
1902			Puntan, Herbert Harding Cruikshank, Borough Analyst's Offic London-chambers, Durban, Natal, S. Africa
1875	Trans.	C. 1888-92 V.P. 1899-1902	Purdie, Thomas, Emeritus Prof., Ph.D. (Würzburg), Hon LL.D. (Aberd.), B.Sc. (Lond.), F.R.S., A.R.S.M., F.I.C. The University, St. Andrews
1901	Trans.		Purvis, John Edward, M.A. (Cantab.), A.R.C.S.I., F.I.C. University Chemical Laboratory, Cambridge
1906			Pye, Thomas Ebenezer, Clovelly, Chichester, Sussex
1886			Pyke, Lazarus Simon Magnus, Assoc.M.Inst.C.E., M.Inst.E.E. 10, Westbourne-terrace, Hyde Park, W.
1905	Trans.		Pyman, Frank Lee, D.Sc. (Vict.), Ph.D. (Bâle), Carlee Selborne-road, Sidcup, Kent

Date of Election.			
1905			Quant, Ernest, 2, Park-crescent, Torquay
1868			Quibell, Oliver, Shalem Lodge, Newark
1894			Quinn, Gerald Grattan, A.R.C.S., Rochdale Technical School, Rochdale
1902			Ralphs, Edwin, Queen's College, Hong Kong
1897			Ralston, William, B.Sc. (Lond.), F.I.C., 149, Onslow-drive, Dennistoun, Glasgow
1892	Trans.		‖Ramage, Hugh, M.A. (Cantab.), A.R.C.S.I., F.I.C., Ridgemont, Carrow-hill, Norwich
1873	Trans.	C. 1886-9, V.P. 92-5, 1897-1900 F.S. 1902-1907 P. 1907-9	†‖Ramsay, Sir William, K.C.B., Ph.D. (Tübingen), Hon. LL.D. (Birm., Glas. and Sheffield), Hon. Sc.D. (Dub. and Cantab.), Hon. D.Sc. (Oxon., L'pool and Columbia), F.R.S., F.I.C., University College, W.C.; and 19, Chester-terrace, Regent' Park, N.W.
1910			Ramsden, Frederick Valentine, The Royal Mint, Melbourne, Australia
1901			Ramsden, William Cecil, 107, Moyne-road, Rathmines, Dublin
1902			Ramshaw, Walter, Oakleigh, Cann-road, Shaftesbury, Dorset
1885			Ranken, Charles, Stockton-road, Sunderland
1889			Ransom, Francis, The Chilterns, Hitchin
1910			Ransome, Alfred Oswald, Beechwood, Greenock-road, Paisley
1911	Trans.		Raper, Henry Stanley, M.Sc. (Vict.), A.I.C., The University Toronto, Canada
1898			Ratcliffe, Walter, 21, Mawdsley-street, Bolton
1905			Ratcliffe, William Henry, B.Sc. (Lond.), 46, Glenhouse-road, Eltham Park, S.E.
1910			Rattey, Clifford Clare, Snaresbrook, Temple-drive, Swinton Manchester
1910			Rau, Malur Srinivasa, M.A., M.D. and B.Sc. (Edin.), D.P.H. (Cantab.), The Chemical Laboratory and Bacteriological Institute, Bangalore, Mysore, S. India
1906			Rawles, Walter Hansen, 81, Lewisham High-road, S.E.
1880			‖Rawson, Christopher, F.I.C., 2, Melbourne-place, Bradford
1884	Trans.		‖Rawson, Sidney George, D.Sc. (Lond.), F.I.C., Battersea Polytechnic, Battersea, S.W.
1898			Ray, John Armstedt, jun., B.A. (Dub.), 15, Nassau-street, Dublin
1908			Ray, Haradhan, M.A. (Calcutta), 9, Protap Chatterjee's-lane, College-street, Calcutta, India
1902	Trans.		Rây, Prafulla Chandra, Prof., Presidency College, Calcutta
1889	Trans.		‖Read, Arthur Avery, Prof., M.Met. (Sheffield), F.I.C., University College, Newport-road, Cardiff

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† Longstaff Medallist, 1897.

Date of Election.			
1895			Read, Edwin James, B.A. (Cantab.), F.I.C., Dart Villa, Victoria-avenue, Westgate-on-Sea
1899	Trans.		Read, Harold McLean, 13, Churchwood-avenue, Far Headingley, Leeds
1900			Readman, James Fraser, 8, Park-avenue, Glasgow
1908			Readwin, William, Elmleigh, Morley, Leeds
1910			Reddie, John Alexander, 3, Spring-gardens, Bradford
1890			Redding, Richard James, 29, Isla-road, Plumstead, Kent
1906	Proc.		Redgrove, Herbert Stanley, B.Sc. (Lond.), 138, Tottenham-court-road, W.
1892			Redman, Henry Ramsden, Oaklands, Barnsole-road, Gillingham, Kent
1866		C. 1891-2 1910-	Redwood, Sir Boverton, Bart., Hon. D.Sc. (Ohio), F.R.S.E., F.I.C., 4, Bishopsgate-street-within, E.C.
1889			Redwood, Robert, 4, Bishopsgate-street-within, E.C.
1886	Trans.		Rée, Alfred, Ph.D. (Berne), 15, Mauldeth-road, Withington, Manchester
1882	Proc.		Reed, Lester, F.I.C., Hyrsthof, 19, South-park-hill-road, South Croydon
1910	Trans.		Reed, Walter William, M.Sc. (Wales), F.I.C., 28, South-parade, Huddersfield
1910			Rees, John James Beaumont, B.Sc. (Lond.), Johannesburg College, Johannesburg, S. Africa
1910			Rees, Thomas John, B.A. (Cantab.), B.Sc. (Wales), Cwmllynfell, Lower Cwmtwrch, Glam.
1909			Regan, Colston James, B.Sc. (Lond.), 14, Penerley-road, Catford, S.E.
1880			‖Regester, William, 13, Corfton-road, Ealing, W.
1897			Reid, Alexander Ferguson, Bonshaw, Stewarton, N.B.
1893			Reid, Thomas Anderson, Crosby, Isle of Man
1881			‖Reid, Walter Francis, F.I.C., Fieldside, Addlestone, Surrey
1910			Rele, Gangaram Rajendrarao, c/o Messrs. Morargee, Goculdass Mills, Ltd., Bombay, India
1907	Trans.		Remfry, Frederic George Percy, B.A. (Cantab.), D.Sc. (Geneva), Croft Lodge, Sandhurst Road, Sidcup, Kent
1897			Remington, John Stewart, Aynsome, Grange-over-Sands, Carnforth, Lancs.
1886			Remington, Joseph Price, Prof., 1832, Pine-street, Philadelphia, U.S.A.
1908			Rennie, Alexander, P.O. Box 703, Johannesburg, Transvaal, S. Africa
1879	Trans.		Rennie, Edward Henry, Prof., D.Sc. (Lond.), F.I.C., The University, Adelaide, S. Australia

Date of Election.			
1898	Proc.		Renwick, Frank Forster, Norland House, Avenue-road, Brentwood, Essex
1909			Resker, Herbert Charles, B.A. (Cantab.), The Sugar Works, Cossipore, India
1902	Trans.		Revis, Cecil, 5, Carlton-villas, Station-road, Barnes, S.W.
1873	Trans.	V.P. 1881-4, 89-92, 97-1900 P. 1901-1903.	Reynolds, James Emerson, Prof., Hon. Sc.D. and Hon. M.D. (Dub.), M.R.C.P. (Ireland), L.R.C.P. and S. (Edin.), F.R.S., 3, Inverness-gardens, Kensington, W.
1898	Trans.		Reynolds, William Colebrook, B.Sc. (Lond.), Meersbrook, Essex-road, Dartford, Kent
1908	Trans.		Rhead, Ezra Lobb, M.Sc. Tech. (Manc.), F.I.C., Stonycroft, Polygon-avenue, Levenshulme, Manchester
1907			Rhodes, Percy Joseph, Bridge House, Church, Lancs.
1898	Trans.		Rich, Edward Milton, 18, Manor-road, Forest Hill, S.E.
1903			Rich, Stiles William George, c/o Messrs. Thomason Chater, Ltd., Stanley-street, South Brisbane, Queensland
1889			Richards, Duncan Taylor, 57, Osborne-avenue, Westoe-lane, South Shields
1889			‖Richards, Edgar, 60, Ayrault-street, Newport, Rhode Island, U.S.A.
1908			Richards, Francis Edward, B.Sc. (Lond.), A.R.C.S., County Secondary School, Redruth
1905			Richards, Frederick George, 43, Bowker-street, Higher Broughton Manchester
1889			‖Richards, Percy Andrew Ellis, F.I.C., Thurn Lodge, Upper Richmond-road, Roehampton, S.W.; and Charing Cross Hospital Medical School, W.C.
1886			Richards, William, B.Sc. (Lond.), 58, Thrale-road, Streatham, S.W.
1885	Trans.		‖Richardson, Arthur, The Central Hindu College, Benares, N.W.P., India
1888	Trans.		‖Richardson, Clifford, A.B. (Harvard), M. Am. Soc. C.E., 30, Church-street, New York City, U.S.A.
1906			‖Richardson, Frederic Ion, B.A. (Cantab.), 38, Alexandra-road, Manchester
1883			Richardson, Frederic William, F.I.C., County Analyst's Office, Bradford
1888			Richardson, Hubert Naylor Bardsley, B.A. (Cantab.), 10, Friar-lane, Leicester
1906			Richardson, Lawrence George, c/o Mrs. Young, Newtown-view, Glenpatrick-road, Elderslie, Johnstone, N.B.
1892			Richardson, Reginald Edensor Stanley, 10, Friar-lane, Leicester

Date of Election.			
1887	Trans.		Richmond, Henry Droop, F.I.C., Mex, Avondale-avenue, Woodside Park, N.
1894			Riddick, David Gibson, Stores Department, G.E.R., Stratford, E.
1882	Trans.		‖Rideal, Samuel, D.Sc. (Lond.), F.I.C., 28, Victoria-street, Westminster, S.W.
1910			Ridgway, Joseph, B.A. (Cantab.), Rownall Hall, Wetley Rocks, Stoke-on-Trent
1882	Trans.		Ridsdale, Charles Henry, F.I.C., Ravenscroft, Roman-road, Linthorpe, Middlesbrough
1888			Rigby, John Samuel, 26, Bagot-street, Wavertree, Liverpool
1905			Rigby, Thomas, c/o Messrs. Crossley Bros., Ltd., Openshaw, Manchester
1898			Rigg, Gilbert, c/o The New Jersey Zinc Co., Palmerton, Carbon Co., Pa., U.S.A.
1851	Trans.	C. 1878-80	Riley, Edward, F.I.C., 14A, Finsbury-square, E.C.
1904			Riley, Louis John Eczekiel, F.I.C., 8, Newton-road, W.
1900			Riley, Walter Alfred, 100, King-street, Norwich
1893			Rintoul, William, F.I.C., Lauriston, Ardrossan, Ayrshire
1909			Ritchings, Walter, M.Sc. (Manc.), 21, Rosehill-road, Burnley
1911	Trans.		Rivett, Albert Cherbury David, B.A. (Oxon.), B.Sc. (Melbourne), The University, Melbourne, Australia
1907			Rixon, Frederic William, M.Sc. (Vict.), Ph.D. (Giessen), 93, Cromwell-road, Bristol
1908			Roach, William Frothingham, M.D. and M.S. (Montreal), L.A.H. (Dub.), 7, Hill-street, Knightsbridge, S.W.
1902			Roast, Harold James, 43, Rielle-street, Cote St. Paul, Quebec, Canada
1893			Robbins, James Henry, B.Sc. (Lond.), 4, Selborne-road, Ilford, Essex
1883			‖Roberts, Frederick George Adair, Chemical Works, Carpenter's-road, Stratford, E.
1899			Roberts, James, jun., 605, Great Western-road, Hillhead, Glasgow
1876			Roberts, Martin Fenn, 137, Victoria-street, S.W.
1894			Roberts, Thomas John, Ingleside, Park-road, Huyton, near Liverpool
1894			Robertson, Archibald Blair, 39, Westbury-road, Bristol
1903	Trans.		Robertson, Philip Wilfred, M.A. (N.Z.), B.A. (Oxon.), Ph.D. (Leipzig), 29, Queen-square, Bloomsbury, W.C.
1907	Trans.		Robertson, Robert, M.A. and D.Sc. (St. Andrews), F.I.C., Research Department, Royal Arsenal, Woolwich, S.E.; and 29, Charlton-road, Blackheath, S.E.
1901	Trans.		Robertson, William, 21, Worfield-street, Battersea Park, S.W.

Date of Election.			
1889			Robins, Harry Hollis, c/o Messrs. Southwell and Co., Dockhead, S.E.
1903			Robinson, Archibald Louis, Surgeon, R.N., M.A. and M.B. (Dub.), Royal Naval Hospital, Malta
1909	Trans.		Robinson, Frederic William, B.Sc. (L'pool), Grove House, Farnworth, Widnes
1896			Robinson, Henry Fishwick, M.Sc. (Vict.), 2, Richmond-street, Droylsden-road, Newton Heath, Manchester
1882	Trans.		‖Robinson, Henry Haliburton, M.A. (Oxon.), F.I.C., 42, Penywern-road, Earls Court, S.W.
1895			Robinson, Herbert Lewin, The Plating Co., 10, Kirby-street, Hatton-garden, E.C.
1910			Robinson, James Beglar, Dairy School, Kilmarnock, N.B.
1907			Robinson, John, Agricultural College, Aspatria, Cumberland
1906			Robinson, Reginald Ernest, B.A. (Cantab.), The Villas, Stoke-on-Trent
1909	Trans.		Robinson, Robert, D.Sc. (Manc.), The University, Manchester
1911	Trans.		‖Robison, Robert, Ph.D. (Leipzig), B.Sc. (Lond.), F.I.C., 227, Woodborough-road, Nottingham
1904			Rodger, Robert, 54, Rostrevor-road, S.W.
1898			Rofe, Henry John, M.A. (Oxon.), 8, Victoria-street, Westminster S.W.
1883			Rogers, Arthur William, Tadcaster Tower Brewery Co., Tadcaster
1884			Rogers, Francis Murray, 21, Burma-road, Stoke Newington, N.
1905			Rogers, Harold Rudolf, M.A. (Oxon.), 38, King-street, Newcastle, Staffs.
1909			Rogers, Herbert, 52, Cannon-street, E.C.
1903			Rogers, William David, B.Sc. (Lond.), A.R.C.S., F.I.C., 18, Gerald-street, Wrexham
1906	Trans.		Rogerson, Harold, M.Sc. (Manc.), Tavistock, Longlands-park-road, Sidcup, Kent
1894			Rolfe, John F., 71, Bristol-road, Edgbaston, Birmingham
1903			Roose, Fitzroy Owen Jonathan, Assoc.Inst.E.E., c/o Cordolia Light, Power and Traction Co., Ltd., Cordolia, Argentine Republic, S. America
1855	Trans.	C.1860-4, 1871-3 V.P.73-5, 1877-80 P. 80-2	Roscoe, Sir Henry Enfield, P.C., B.A. (Lond.), D.C.L., (Oxon.), LL.D. (Cantab., Dub., Glas., Montreal, Aberd.), Ph.D. and Hon. M.D. (Heidelberg), Hon. D.Sc. (Vict.), F.R.S., 10, Bramham-gardens, S. Kensington, S.W.
1910			Rose, John George, Government Analytical Laboratory, Cape Town, S. Africa
1891	Trans.	C. 1897-8.	‖Rose, Thomas Kirke, D.Sc. (Lond.), 6, Royal Mint, E.
1896	Trans.		Rosenheim, Otto, Ph.D. (Würzburg), 188, Hampstead-way, Hendon
1894			Ross, Arthur, F.I.C., 1, Glengall-road, Old Kent-road, S.E.

Date of Election.			
1905			Ross, Frederick Wilson Montrose, 21, Soho-square, W.
1870			Ross, Lewis Buttle, Driffield, Yorks.
1896			Ross, Raymond St. George, F.I.C., Public Analyst's Office, Burnley
1902			Ross, William Charles, Capt., I.M.S., M.B., Ch.B. and D.P.H. (Edin.), Deputy Sanitary Commissioner, Bankipore, E.I.R., Bengal, India
1891	Proc.		Rossiter, Edmund Charles, F.I.C., 4, Park-road, West Smethwick, Birmingham
1892			Rothwell, Charles Frederick Seymour, Beech Croft, Mobberley, Knutsford
1904			Rouillard, Marie Jean Louis Ernest, B.Sc. (Edin.), Malvern, Natal, S. Africa
1906			Rowsell, Philip Foale, Nutbrook, Exmouth, S. Devon
1900			Roy, Mathura Goolab, 74, Iyah Mudali-street, Chintadrepettah, Madras, India
1899			Royal-Dawson, Henry, c/o Messrs. Peyton and Son, Lister-street, Birmingham ; and 27, Westbourne-road, Walsall
1901			Royle, Charles Leonard, 1, Wigram-road, Wanstead, N.E.
1905			Royle, Harold Marmion, Store House, Gas Works, Beckton, North Woolwich
1909			Rudolf, Norman Scott, Prof., M.Sc. (Vict. and L'pool), F.I.C., Indian Institute of Science, Bangalore, India
1872	Trans.		Ruffle, John, F.I.C., Musley, Ware, Herts.
1895			Rugginz, William Augustus, Beaulieu, Derby-road, Woodford, N.E.
1889	Trans.	C. 1903-05	Ruhemann, Siegfried, M.A. (Cantab.), Ph.D. (Berlin), Gonville and Caius College, Cambridge
1883			Rumble, Charles, F.I.C., 154, Valley-road, Streatham, S.W.
1908			Runeckles, Arthur Robert, B.Sc. (Lond.), A.C.G.I., 1, Ellys-road, Coventry
1890			‖Russell, Edward, B.Sc. (Lond.), F.I.C., 28, Apsley-road, Clifton
1898	Trans.		Russell, Edward John, D.Sc. (Lond.), Lawes Agricultural Trust, Rothamsted Experimental Station, Harpenden, Herts.
1901			Russell, James Bertram, B.Sc. (Lond.), Marston, Belsize-road, Worthing
1910			Russell, John, B.A. (Oxon.), 30, Edgedale-road, Millhouses, Sheffield
1908			Rutter, Clement Thomas, 8, Norwood-view, Halfacre-road, Hanwell, W.
1896			Rutter, Thomas Francis, B.Sc. (Lond.), Ph.D. (Leipzig), Newcastle-under-Lyme
1894			Ryce, George, B.A. (R.U.I.), Irish Agricultural Offices of the Potash Syndicate, 50, Essex-street, Dublin

Date of Election.		
1901	Trans.	Ryffel, John Henry, M.A. (Cantab.), B.Sc. (Lond.), F.I.C., 10, Grasmere-road, Muswell Hill, N.
888		‖Sach, Albert John, Technical College, Goulburn, N.S.W.
868		Sadler, Sir Samuel Alexander, Col., Cleveland Chemical Works, Middlesbrough
896		Sage, Charles Edward, F.I.C., 41, Cheapside, E.C.
909	Trans.	Sageman, Philip John, Government Laboratory, Clements Inn-passage, Strand, W.C.
907		Sahni, Ruchi Ram, M.A. (Punjab), Government College, Lahore, India
879	Trans.	‖Sakurai, Joji, Prof., Science College, Imperial University, Tokio, Japan
880		Salamon, Alfred Gordon, A.R.S.M., F.I.C., 1, Fenchurch-avenue, E.C.
908		Salamon, Maurice Salamon, 64, Oxford-gardens, N. Kensington, W.
906		Salmon, Frederick John, c/o Government Survey Department, Colombo, Ceylon
876		‖Salomons, Sir David Lionel, Bart., M.A. (Cantab.), Assoc. Inst.C.E., J.P., D.L., Broomhill, Tunbridge Wells; and 49, Grosvenor-street, W.
863		‖Salt, Henry, M.D. and C.M. (Edin.), Inglewood, Great Malvern
871		‖Salter, Mortyn John, F.I.C., Bank House, Mickleton, Campden, Glos.
859		‖Salter, Thomas William, 193, Priory-road, West-hill, Hastings
907	Trans.	Salway, Arthur Henry, D.Sc. (Lond.), Ph.D. (Leipzig), 51, Goodmayes-avenue, Goodmayes, near Ilford, Essex
902		Sampson, John William, 4, Adelaide Road, Brockley, S.E.
882		Samuel, William Cobden, Elmdale, 66, Croxted-road, West Dulwich, S.E.
909		San U, Maung, Chemical Examiner's Office, Rangoon, Burma
898	Trans.	‖Sand, Henry Julius Salomon, Ph.D. (Zürich), D.Sc. (Birm.) University College, Nottingham
870		‖Sandberg, Christer Peter, Palace-chambers, 9, Bridge-street, Westminster, S.W.
900	Proc.	Sanders, James McConnell, c/o Direccion General de Aduanas, Mexico
904		Sanders, Percy Richard, West Cliffe, Seaford, Sussex
888		Sanderson, John, F.I.C., c/o Messrs. B. S. Cohen, Ltd., 15, Clerkenwell-close, E.C.
890		Saniter, Ernest Henry, Strafford Villa, Moorgate, Rotherham

Date of Election.		
1891		Sanyal, Abhayacharan, Prof., M.A. (Calcutta), Queen's College, Benares, N.W.P., India
1892		Sarbadhicary, Satya-prasad, 1, College-street, Calcutta
1900		Sargeant, Fred Pilkington, College of Pharmacy, Clarendon-road, Leeds
1907		Saunders, George Joseph, B.E. (Sydney), Central Technical College, Brisbane, Queensland, Australia
1886		Saunders, William, Prof., Experimental Farm, Ottawa, Canada
1908		Saunderson, William, B.Sc. (Lond.), Armidale School, Armidale, N.S.W.
1909		||Sawbridge, Bartle Frere, M.A. (Oxon.), F.I.C., 90, Guilford-street, Russell-square, W.C.
1898		Sayer, Harold Charles, 51, Highfield-road, Dartford
1890		Sayers, William Charles, 63, High-street, Lewisham, S.E.
1885		||Scammell, Luther Robert, c/o Messrs. F. H. Faulding & Co., 54, King William-street, Adelaide, S. Australia
1877		Scarf, Isaac Sydney, F.I.C., City of London School, Victori Embankment, E.C.; City of London College, White-street, Moorfields, E.C.; and 88, Palmerston-crescent, Palmer' Green, N.
1897		Scargill, Lionel Walter Kennedy, M.A. (Oxon.), 22, Cambridge-street, Eccleston-square, S.W.
1893	Trans.	Schidrowitz, Philip, Ph.D. (Berne), 57, Chancery-lane, W.C.
1888		||Schieffelin, William Jay, Ph.B. (Columbia), 170, William-street, New York City, U.S.A.
1907		Schlinger, Charles, B.Sc. (Lond.), Acadia House, 273, Camden-road, N.
1905		Schnurmann, Harry Nestor-, Berrington, Brondesbury Park, N.W.
1907		Schober, William Bush, A.M. and B.Sc. (Annapolis), Ph.D. (Johns Hopkins), Lehigh University, South Bethlehem, Pa., U.S.A.
1892		||Schofield, James Alexander, A.R.S.M., F.I.C., The University, Sydney, N.S.W.
1903		Scholefield, Alfred Henry, B.A. and B.Sc. (Lond.), 57, Th Avenue, Leigh, Lancs.
1905	Trans.	Scholefield, Fred., M.Sc. (Vict.), B.Sc. (Lond. and Leeds), A.I.C., c/o Messrs. R. P. Lawson & Sons, Britannia Mills, Hulme-hall-road, Hulme, Manchester
1902		Scholes, William, Mount Sion, Radcliffe, Lancs.
1899	Trans.	Schryver, Samuel Barnett, D.Sc. (Lond.), Ph.D. (Leipzig), 48, Overstrand Mansions, Battersea Park, S.W.
1909		Schulten, Joseph Henry Charles, Ph.D. (Erlangen), P.O. Box 279, 4, Pollock-street, Calcutta, India

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896			Scotland, Peter Bain, c/o The Arizona Copper Co., Ltd., Metcalf Mines, Clifton, Arizona, U.S.A.
879	Trans.	C.1897-9 S. 1899-1904 T. 1904-	‖Scott, Alexander, M.A. and Sc.D. (Cantab.), D.Sc. (Edin.), F.R.S., F.I.C., 34, Upper Hamilton-terrace, St. John's Wood, N.W.
908			Scott, Andrew Laidlaw, F.I.C., Royal Gunpowder Factory, Waltham Abbey, Essex
890			Scott, Ernest George, 2, Talbot-court, Gracechurch-street, E.C.
901			Scott, George Charlton, c/o Messrs. Burn & Co., Ltd., Raneegunge, Bengal, India
905			Scott, John Irwin, M.A. (Oxon.), 28, Thorpe Lea-road, Peterborough
906			Scouller, Walter Daly, B.Sc. (Vict.), Chester Corporation Sewage Purification Works, Chester
883	Proc.		Scudder, Frank, F.I.C., 44, Mosley-street, Manchester
906			Seaber, Willie Macro, B.Sc. (Lond.), A.I.C., Firdale, Sheen-lane, East Sheen, S.W.
896			Seabrooke, Herbert Cecil, F.I.C., Black Ash, Grays, Essex
891			Searl, Albert, Montreux, Victoria-road, Sidcup, Kent
905			Seaton, William Dunham, 40, Argyle-road, Ilford, Essex
908			Seelhorst, William, c/o Eastern Smelting Co., Ltd., Penang, Straits Settlements
909			Segaller, David, B.Sc. (Lond.), A.R.C.S., 2, Cannon Hill-terrace, Kingston-road, Merton Park, S.W.
898			Seligman, Richard, Ph.D. (Heidelberg), A.C.G.I., Oakwood, Oxshott-road, Leatherhead
892	Trans.	C. 1905-09	Sell, William James, M.A. and Sc.D., (Cantab.), F.R.S., F.I.C., University Chemical Laboratory, Pembroke-street, Cambridge
875			Sellon, John Scudamore, 78, Hatton-garden, E.C.
910			Sen, Aswini Kumar, B.A. (Calcutta), B.Sc. (Vict.), The Bengal Luxmi Mills, Serampore, near Calcutta, India
906			Sen, Gopal Chandra, M.A. (Calcutta), Bengal Technical Institute, 92, Upper Circular-road, Calcutta, India
904	Trans.		Sen, Jatindra Nâth, M.A. (Calcutta), Agricultural Research Institute, Pusa, Bengal, India
910	Trans.		Sen, Rajendra Nath, M.A. (Calcutta), M.Sc. (Leeds), Engineering College, Sibpur, Calcutta, India
875	Trans.		‖Senier, Alfred, Prof., Hon. D.Sc. (R.U.I.), M.D. (Mich.), Ph.D. (Berlin), F.I.C., University College, and Gurthard, Galway, Ireland
906			Senior, John, c/o Messrs. Morgan, Crossley & Co., Ltd., Ducie Mills, Miles Platting, Manchester
903	Trans.		Senter, George, D.Sc. (Lond.), Ph.D. (Leipzig), Chemical Laboratory, St. Mary's Hospital Medical School, Paddington, W.

Date of Election.		
1896		Severn, Walter Dalrymple, A.R.C.S., Public Health Laborato Cape Town, S. Africa
1870	Trans.	Seward, Henry, c/o Messrs. J. B. Freeman, Sons, and C Wandle Colour Works, Wandsworth, S.W.
1907		Sewell, William George, B.Sc. (Lond.), Bournemouth Scho Bournemouth
1874		‖Sexton, Alexander Humboldt, Prof., F.I.C., F.R.S. c/o The Librarian, The Technical College, 204, George-stre Glasgow
1895	Trans.	Seyler, Clarence Arthur, B.Sc. (Lond.), F.I.C., The Techni Institute, Nelson-terrace, Swansea
1904		Shacklady, Thomas George, Hope House, Cliffe-at-Hoo, Roches
1880		Shadwell, John Emilius Lancelot, F.I.C., Milton House, Bat wick-hill, Bath
1910		Shah, Motilal Kashalchand, c/o The Gujarat Candle Factory a Asbestos Works Co., Ltd., Hansraj-lane, Byculla Brid Bombay, India
1874		Sharman, William, 186, Mare-street, Hackney, N.E.
1910		Sharpe, Frederic Herbert, The Ferns, Cressington - par Liverpool.
1895		Sharrott, Thomas Chilwell, B.A. (Dub.), A.R.C.S., F.I. 60, Albert-road, Tamworth
1895	Trans.	‖Shaw, George Elliott, B.Sc. (Lond.), F.I.C., Mungpoo P. Sonada, D.H. Railway, Bengal, India
1908	Proc.	Shaw, William Bayliss, B.A. and B.Sc. (Oxon.), Lonsdale Hous Walsall
1887		Sheard, John Tomlinson, Birley Carr, Sheffield
1899		Shelbourn, Edward Thomas, F.I.C., 40, Craven-street, Strand, W.
1904	Proc.	Shelton, Henry Stanley, B.Sc. (Lond.), Silvermead, Ashfor Middlesex
1897		Shenton, James Porter, 37, Torbay-road, Chorlton-cum-Hard near Manchester
1907	Trans.	Shepheard, Frederick George, B.Sc. (Lond.), A.R.C.S., A.I.C 5, University-road, Galway, Ireland
1899	Trans.	Shepheard, William Frederick John, 12, Bridge-street-row, Chest
1906		Shepherd, Arthur Burton, B.Sc. (Vict.), F.I.C., c/o The Britis Oil and Cake Mills, Ltd., Copenhagen Mill, Limehouse, E.
1874		‖Shepherd, Harcourt Henry Benjamin, F.I.C., Crayside, Bexley Kent
1899		Shepherd, John William, B.Sc. (Lond.), 3, Fairlawn-road Wimbledon, S.W.
1901	Trans.	Sheppard, Samuel Edward, D.Sc. (Lond.), 100, Bromley-road Catford, S.E.

Date of Election.		
1901		Shepperson, William, 53, Queensborough-terrace, Hyde Park, W.
1891	Trans.	‖Shields, John, D.Sc. (Edin.), Ph.D. (Strassburg), F.I.C., 4, Stanley-gardens, Cricklewood, N.W.
1908		Shilstone, Herbert Maxwell, B.Sc. (Tulane), 3439, Prytania-street, New Orleans, U.S.A.
1896		Shimomura, Kotaro, Prof., Shinkarasumara, Kajinguchi Sagaru, Kyoto, Japan
1894		Shorthouse, Herbert Stephen, 144, Edmund-street, Birmingham
1906		Shrimpton, John Kirby, Redshaw House, Ripon
1904		Shrubsole, Alfred, 16, The Grove, Golders Green, N.W.
1886		Shutt, Frank Thomas, M.A. (Toronto), F.I.C., Experimental Farm, Ottawa, Canada
1890		Shuttlewood, Willis Brewin, 78, Whitehall-park, Hornsey-lane, Highgate, N.
1894		Shuttleworth, Edward Buckingham, Prof., 220, Sherborne-street, Toronto, Canada
1904		Siau, Raymond Louis, 15, Merridale-lane, Wolverhampton
1903		Sibley, Samuel Edward, Tottenham, Warren-road, Marrickville, Sydney, N.S.W.
1889		Sibson, Alfred Edward, 92, Lansdowne-place, Hove, B.O., Brighton
1903		Siddle, George, Middleton-one-row, Co. Durham
1902	Trans.	‖Sidgwick, Nevil Vincent, M.A. (Oxon.), Sc.D. (Tübingen) Lincoln College, Oxford
1900	Trans.	Silberrad, Oswald, Ph.D. (Würzburg), Buckhurst Hill, Essex
1886		Silvester, Harry, Hon. B.Sc. (Birm.), F.I.C., 78, Holy Head-road, Handsworth, Birmingham
1906		Sime, Allan, Box 19, Port Limon, Costa Rica, S. America
1899	Trans.	Simmonds, Charles, B.Sc. (Lond.), Airdrie, 61, Cottenham-park-road, Cottenham-park, Wimbledon, S.W.
1889		Simmonds, Henry, Engineer's Office, Gas Works, and Elton View House, Bury, Lancs.
1887		‖Simmons, Leonard Owen, 45, Wavertree-rd., Streatham Hill, S.W.
1905		Simmons, William Herbert, B.Sc. (Lond.), Oakleigh, Stoke Newington Common, N.
1895		Simons, Albert Joseph, c/o M. Simons, Esq., 31, Little Britain, E.C.
1906	Trans.	Simonsen, John Lionel, Prof., D.Sc. (Manc.), Presidency College, Madras, India
1896		Simpson, Aitken Megget, 27, York-grove, Queen's-rd., Peckham, S.E.
1902		Simpson, Duncan Ivan Rennard, c/o Willoughby's Consolidated Co., Ltd., P.O. Box 220, Bulawayo, S. Africa
1897		Simpson, Edward Sydney, B.E. (Sydney), Geological Survey Laboratory, Museum-street, Perth, Western Australia

Date of Election.		
1886	Proc.	‖Simpson, William Selby, F.I.C., The Gables, Cannon-hill Southgate, N.
1910		Sinclair, St. Clair Overbeek, M.A. (Cape of Good Hope), Government Analytical Laboratory, Grahamstown, Cape Colony S. Africa
1902	Proc.	Sindall, Robert Walter, 201, Wellmeadow-road, Catford, S.E.
1889		Singer, Ignatius, 3, Parkfield-road, Manningham, Bradford
1908		Singh, Puran, Acting Imperial Forest Chemist, Dehra Dun U.P., India
1909		Sinha, Manindra, B.A. (Allahabad), St. Xavier's College, 10 an 11, Park-street, Calcutta, India
1902	Proc.	Sinnatt, Frank Sturdy, 321, Great Clowes-street, Higher Broughton, Manchester
1896		‖Sircar, Amrita Lal, 51, Sankaritola, Calcutta, India
1902		Skertchly, William Pearson, F.I.C., 11, Billiter-square, E.C.
1888	Trans.	Skinner, Sidney, M.A. (Cantab.), South Western Polytechnic Manresa-road, Chelsea, S.W.
1899	Trans.	Skirrow, Frederick William, M.Sc. (Vict.), Ph.D. (Leipzig Roeburndale, Mellor, Derbyshire
1892		Skurray, Thomas, United Breweries, Abingdon, Berks.
1910	Trans.	Slade, Roland Edgar, M.Sc. (Vict.), Muspratt Laboratory, Th University, Liverpool
1879		Slater, Charles, M.A. and M.B. (Cantab.), M.R.C.S. (Eng.), 8 St. Ermin's-mansions, Westminster, S.W.
1880	Trans.	‖Slater, Harold Humboldt, F.I.C., Club de Residentes Extranjero Buenos Ayres, Argentine, S. America
1903	Trans.	Slator, Arthur, Ph.D. (Leipzig), D.Sc. (Birm. and Lond.), F.I.C The Priory, Burton-on-Trent
1878		‖Slatter, George William, A.R.C.S.I., F.I.C., 241, Carlton-terrac Nab Wood, Shipley, Yorks.
1895		Slocum, Frank Leroy, Ph.D. (Strassburg), 401, South Linde avenue, E.E., Pittsburg, Pa., U.S.A.
1875		‖Smetham, Alfred, F.I.C., 16, Brunswick-street, Liverpool
1898	Trans.	Smiles, Samuel, D.Sc. (Lond.), University College, Gower-stree W.C.
1883		Smith, Adolphe, 12, Crookham-road, Fulham, S.W.
1890	Trans.	‖Smith, Alexander, Prof., Ph.D. (Munich), B.Sc. (Edin.), Department of Chemistry, Columbia University, New York City, U.S.
1901		Smith, Andrew Biggam, c/o M. Armstrong, Esq., P.O. Box 9 Queenstown, Cape Colony, S. Africa
1888		Smith, Angus, F.I.C., 10, Ardgowan-street, W., Greenock, N.
1898		Smith, Benjamin Jordan-, 11, Grosvenor-road, Handsworth, Bi mingham
1906		Smith, Charles, Knowsley-road, Smithills, Bolton

Date of Election.		
1903		Smith, Charles Joseph, Sunnydale, Walton New-road, Stockton Heath, near Warrington
1904	Trans.	Smith, Clarence, D.Sc. (Lond.), 28 Chadwick-road, Leytonstone, N.E.
1894	Trans.	Smith, Claude, F.I.C., Barngarth, Cartmel, Carnforth
1884		‖Smith, Edgar Francis, Trelawny, 21, Fairfax-road, Bedford Park, W.
1910		Smith, Ernest William, B.Sc. (Lond.), 20, St. Bevan's-road, Halifax
1906		Smith, Frank, B.Sc. (Vict.), 51, Hilden-street, Haulgh, Bolton
1874		Smith, George, F.I.C., Nobel's Explosives Co., Polmont Station, N.B.
1896		Smith, George Egerton Scott-, F.I.C., 67, Surrey-street, Sheffield
1892		‖Smith, George Percy Darnell-, B.Sc. (Lond.), F.I.C., Chief Secretary's Department, Bureau of Microbiology, Sydney, N.S.W.
1896	Trans.	Smith, Henry George, The Technological Museum, Sydney, N.S.W.
1904		Smith, Henry Heron, F.I.C., 76, Plumstead-common-road, Plumstead, Kent
1909	Trans.	Smith, Henry Llewellyn, B.Sc. (Manc.), F.I.C., King's College, Strand, W.C.
1878		Smith, Henry Russell, F.I.C., 1, Aubert-park, Highbury, N.
1900		‖Smith, Herbert Procter, Highfield, Shotton, Flints.
1901		Smith, James, Sunnyside, Groes-road, Cressington, Liverpool
1903		Smith, James Cruickshank, B.Sc. (Aberd.), King's House, King-street, E.C.
1910		Smith, James Harry, 318, Edenfield-road, Norden, Rochdale
1879		‖Smith, John William, 7, Brookfield-street, Roslindale, Boston, Mass., U.S.A.
1901	Trans.	Smith, Norman, D.Sc. (Vict.), The University, Manchester
1910		Smith, Percy Lancelot James, M.A. (Oxon.), A.I.C., Army College, Storrington, Pulborough, Sussex
1902		Smith, Robert Ely Blake, B.Sc. (Lond.), A.I.C., 31, St. John's-road, Putney, S.W.
1897		Smith, Robert Francis Wood, 90, Lower Thames-street, E.C.
1891		Smith, Robert Greig-, D.Sc. (Edin.), M.Sc. (Dun.), Linnean Society's House, Elizabeth Bay, Sydney, N.S.W.
1907		Smith, Robert Harry, Apsley House, Priory-road, Sheffield
1907		Smith, Robert Low, c/o Messrs. Vickers, Sons and Maxim, Ltd., Erith, Kent
1888		Smith, Samuel, Hillsboro', Goddard-avenue, Old Swindon
1907		‖Smith, Sydney William, B.Sc. (Lond.), A.R.S.M., The Royal Mint, E.

Date of Election.			
1910			Smith, Thomas May, c/o Messrs A. Boake, Roberts & Co., Ltd. Carpenter's-road, Stratford, E.
1866	Trans.		Smith, Watson, F.I.C., 34, Upper-park-road, Haverstock Hill, N.W
1876			‖Smith, William Alexander, M.A. and M.B. (Oxon.), M.R.C.S (Eng.), 70, Pembroke-road, Clifton, Bristol
1910			Smith, William James Pittock, 9, Meddowcroft-road, Wallasey Birkenhead
1903			Smith, William Veysey, B.A. (Oxon.), 38, St. Petersburgh place, W.
1883	Trans.	C. 1896-1900. V.P. 1905-08	‖Smithells, Arthur, Prof., B.Sc. (Lond.), F.R.S., F.I.C., Th University, Leeds
1873			‖Smyth, John, M.A. (Dub.), M.Inst.C.E., Milltown, Banbridge Ireland
1908	Trans.		Smythe, John Armstrong, D.Sc. (Dun.), Ph.D. (Göttingen Armstrong College, Newcastle-on-Tyne
1902			Smythe, John Seabury, M.Sc. (Vict.), Ph.D. (Würzburg Rocklands, Sandown-park, Wavertree, Liverpool
1887	Trans.		‖Snape, Henry Lloyd, Prof., D.Sc. (Lond.), Ph.D. (Göttingen F.I.C., Balholm, Lathom-road, Southport
1899	Trans.		Soddy, Frederick, M.A. (Oxon.), F.R.S., Chemical Departmen The University, Glasgow
1887			Sohn, Charles Emile, F.I.C., 52, Fore-street, E.C.
1891			Solomon, Frank Oakley, Dauntsey's Agricultural School, We Lavington, Devizes, Wilts.
1906			Sommerville, David, B.A. (R.U.I.), M.D., B.Ch., and D.P.H (Cantab.), M.R.C.P. (Lond.), 31, Manor House, Marylebone-roa N.W.
1910			Sorabji, Kaikhushroo Bamanji, L.M. and S. (Bombay), Secu derabad, Deccan, India
1893			Sorrell, Henry Thomas, Stapenhill, Wilton-avenue, Southampto
1875			Southall, Alfred, Garrick House, Richmond Hill, Edgbaston
1908			Southcombe, James Edward, M.Sc. (L'pool), 138, Chester- Birkenhead -street,
1897	Proc.		Southerden, Frank, B.Sc. (Lond.), F.I.C., Royal Albe College, Exeter
1910	Trans.		Southgate, Herbert William, B.Sc. (Lond.), 130, P in.), Da Westminster, S.W.
1883			Soward, Alfred Walter, 28, Therapia-road, Honor Oak, S.E.
1892			Spackman, Charles, Rosehaugh, Clitheroe, Lancs.
1908			Speed, John Day, 206, Hertford-road, Waltham Cross
1905			Speight, William Ewart, Corporation Sewage Works, Deighto Huddersfield

te of ection.		
83		‖Spencer, Ernest Samuel, 181, Drummond-road, Southwark Park, S.E.
06	Trans.	Spencer, James Frederick, D.Sc. (L'pool), B.Sc. (Vict.), Ph.D. (Breslau), Bedford College for Women, Baker-street, W.
86		Spencer, Richard, 242, Dalton-road, Barrow-in-Furness
87		‖Spencer, Walter Shelley, Lyndene, Darley-grove, Farnworth, near Bolton
94		Spenzer, John George, Prof., M.D. (Ohio), Ph.D. (Strassburg), Ohio Wesleyan University, 1825, East 93rd street, N.E., Cleveland, Ohio, U.S.A.
04		Spielmann, Percy Edwin, B.Sc. (Lond.), Ph.D. (Bâle), A.R.C.S., F.I.C., 21, Cadogan-gardens, S.W.
08		Spiers, Charles Sedgley, Beaudesert, Queensland, Australia
59	Trans.	‖Spiller, John, F.I.C., 2, St. Mary's-road, Canonbury, N.
63		‖Spiller, William, F.I.C., 2, Lindfield-gardens, Hampstead, N.W.
85		‖Spottiswoode, William Hugh, Balliol College, Oxford; and 6, Middle New-street, E.C.
06	Trans.	Sproxton, Foster, B.Sc. (Lond.), Brantham Works, near Manningtree, Essex
82		‖Squire, Peter Wyatt, 413, Oxford-street, W.
92		Squires, Alfred James, Greenbank, Coroner's-lane, Farnworth, Widnes, Lancs.
77		Stacey, Henry George, Brunton's Wharf, 671, Commercial-road, E.
99		Stainer, John Ward, 103, Cheriton-road, Folkestone
79	Trans.	‖Stallard, George, M.A. (Oxon.), Horton-crescent, Rugby
11		Stanford, Robert Viner, Ph.D. (Kiel), M.Sc. (Birm.), B.Sc. (Lond.), Cardiff City Mental Hospital, Whitchurch, Cardiff
10		Stanford, Spencer Boyd Cortis-, St. Margaret's, Bishopbriggs, Glasgow
04		Stanger, Reginald Harry Hursthouse, Chemical Laboratory and Testing Works, 2, Broadway, Westminster, S.W.
02		Stanger, William Charles South, Ambleside, Corder-road, Ipswich
90		‖Stansell, Lionel William, F.I.C., 7, Albion-place, Maidstone, Kent
897		‖Stansfield, Alfred, D.Sc. (Lond.), McGill University, Montreal, Canada
891		Stansfield, Edgar, M.Sc. (Vict.), 200, Elgin-street, Ottawa, Canada
99		Stansfield, Samuel, B.Sc. (Vict.), 2, Park-road, Batley, Yorks.
00	Trans.	Stapleton, Henry Ernest, Prof., M.A. and B.Sc. (Oxon.), The Club, Dacca, Eastern Bengal and Assam, India
70		Starey, Arthur John, 39, Woodland-gardens, Highgate, N.
70	Trans.	‖Stark, James Fleming, Rosedale, Bromborough, Cheshire
06		Starling, William Robert Rigg, 23, Magdalen-road, Norwich

Date of Election.		
1908		Stead, Arthur, B.Sc. (Vict.), Government Laboratories, Bloen fontein, Orange River Colony, S. Africa
1902		Stead, Francis Bernard, 80, St. Mary's-mansions, Paddington, W
1896		Stead, John Christopher, 55, Chancery-lane, W.C.
1882	Trans.	Stead, John Edward, D. Metall. (Sheffield), F.R.S., F.I.C., 1 Queen's-terrace, Middlesbrough
1910		Stedman, Ernest, M.Sc. (Vict.), 6, Breakwater-road, Bud Cornwall
1897		Steel, Frederick William, c/o General Chemical Co., Ltd., Clyd Sydney, N.S.W.
1885		‖Steel, Robert Elliot, Cameron House, Sherborne, Dorset
1900	Trans.	Steele, Bertram Dillon, Prof., D.Sc. (Melbourne), The Universit Brisbane, Queensland, Australia
1905		Steger, James, B.Sc. (Lond.), 111, Chesterfield-road, Bristol
1898		Steinhart, Oscar Julian, Ph.D. (Erlangen), 65, London-wall, E.
1901		Stell, Samuel Fenton, 25, Henry-street, Keighley
1892	Trans.	‖Stenhouse, James, Kenmore, Lasswade, Midlothian
1884		Stenhouse, Thomas, F.I.C., 166, Drake-street, Rochdale
1895	Trans.	Stephens, Frank Robert, c/o Messrs. Idris, Pratt-street, Camd Town, N.W.
1880		‖Stephens, Henry Charles, Avenue House, Finchley, N.
1897		Stephens, Michael Edmund, 57, Aldersgate-street, E.C.
1910		Stephenson, Guy, Alexandra-terrace, Crook, Co. Durham
1895		Stephenson, Herbert Frederick, A.R.C.S., F.I.C., 7, Winifred-roa Merton Park, S.W.
1901		Stephenson, Robert, jun., M.A. (Cantab.), Burwell, Cambridge
1891	Trans.	Stephenson, Thomas, F.R.S.E., 137, George-street, Edinburgh
1888	Trans.	Stern, Arthur Landauer, D.Sc. (Lond.), F.I.C., 148, High-stre Burton-on-Trent
1896		Steuart, Douglas Stuart Spens, B.Sc. (Vict.), The Royal Societi Club, St. James's-street, S.W.
1905		Stevens, Harold Blythen, Oxford Works, Tower Bridge-road, S.
1897	Trans.	Stevens, Henry Potter, M.A. (Oxon.), Ph.D. (Heidelber F.I.C., 15, Borough, London Bridge, S.E.
1903		Stevens, Montague White, A.R.C.S., A.I.C., H.M. Patent Offi 25, Southampton-buildings, W.C.
1899		Stevenson, Arnold, B.A. (Cantab.), 4, Porchester-gardens, W.
1903	Trans.	Stevenson, Henry Edward, Entwistle, Empress-avenue, Woodfo N.E.
1904		Stevenson, Henry Ernest, Avondale, Ditton Hill, Surrey
1909		Stevenson, James Thomas, 67, Surrey-street, Sheffield
1879		§Stevenson, William, 95A, Southwark-street, S.E.
1908		Stewart, Alexander Mackintosh, Penang, Straits Settlements
1903	Trans.	Stewart, Alfred Walter, D.Sc. (Glas.), 7, Upper-crescent, Belfa

te of ection		
02		Stewart, Hector, Solai, Wagin, Western Australia
07		Stobie, Harold Ramsay, Bryn Issa, Hadley Wood, Barnet
66		Stock, William Frederick Keating, F.I.C., 5, Dixon-terrace, Darlington
87		Stocks, Herbert Birtwhistle, F.I.C., 12, Victoria-road, West Kirby, Cheshire
94	Trans.	Stoddart, Frederick Wallis, F.I.C., Grafton Lodge, Sneyd-park, Bristol
79	Proc.	‖Stokes, Alfred Walter, F.I.C., Town Hall, Paddington Green, W.
73		‖Stone, Edward Daniel, Ackersley, Cheadle Hulme, near Stockport, Cheshire
95		Stone, George, Esk Brewery, Launceston, Tasmania
75		‖Stone, John Frederic Matthias Harris, M.A. (Cantab.), Barrister-at-Law of the Western Circuit, 3, Dr. Johnson's-buildings, Temple, E.C. ; and Oxford and Cambridge Club, 17, Pall Mall, S.W.
79		‖Stone, William, M.A. (Cantab.), Oxford and Cambridge, Garrick, Bath, Union, Royal Societies, Automobile, and Reform Clubs ; and 63, Curzon-street, Mayfair, W.
09		Stones, George Bertram, M.Sc. (Manc.), Bank-villas, Tyldesley, Manchester
06		Storey, Francis Wylie, B.Sc. (Lond.), Grey College School, Bloemfontein, Orange River Colony, S. Africa
00		Storr, Bertram Vincent, M.Sc. (Vict.), 147, Coventry-road, Ilford, Essex
09		Strachan, James Thallon, 10, Nelson-street, Sunderland
87		‖Strangman, James Pim, Clydesdale-mansions, 9, Clydesdale-road, Notting Hill, W.
04	Trans.	Streatfeild, Frederick Henry, 9, Crescent-road, South Tottenham, N.
06		Streimer, Emanuel George, 4, Clova-road, Forest Gate, E.
09		Strohmenger, Arthur Percy, Caxton House, Westminster, S.W.
00		Strong, Archie Hugh, 63, Herne-hill-road, Camberwell, S.E.
04	Trans.	‖Struthers, Robert de Jersey Fleming-, M.A. and B.Sc. (Oxon.), Exeter College, Oxford
85	Trans.	‖Stuart, Charles Maddock, M.A. (Cantab.), F.I.C., St. Dunstan's College, Catford, S.E.
10		Stuart, Murray, Prof., B.Sc. (Birm.), The University, Madras, India
97	Trans.	Stubbs, George, Beresford House, Beresford-road, East Finchley, N.
07		Sturrock, George Colleymore, Capt. R.A., Indian Cordite Factory, Aruvankad, Nilgiris, India
90	Trans.	‖Sudborough, John Joseph, Prof., D.Sc. (Lond.), Ph.D. (Heidelberg), F.I.C., Indian Institute of Science Bangalore, India

Date of Election.		
1878	Trans.	‖Suguira, Shigetake, c/o Tokyo Chemical Society, Science College, Imperial University, Tokyo, Japan
1911		Summers, George Douglas, Grammar School, Tideswell, Buxton
1904		Sutcliffe, Thomas, The Grammar School, Elland, Yorks.
1887		‖Sutherland, David Alexander, F.I.C., 26, Victoria-street, Westminster, S.W.
1860		Sutton, Francis, F.I.C., Laboratory, Bank Plain, Norwich
1886		‖Sutton, Francis Napier, F.I.C., 6, Grosvenor-gardens, Cricklewood, N.W.
1902		Swain, James, 17, Winsham-grove, Clapham Common, S.W.
1875		Swan, Sir Joseph Wilson, Hon. M.A. and Hon. D.Sc., (Dun.), F.R.S., F.I.C., Overhill, Warlingham, Whyteleaf, Surrey
1894		‖Swinburne, James, F.R.S., M.Inst.C.E., 82, Victoria-street, S.W.
1891		Sykes, Matthew Carrington, M.D. (Dun.), F.R.C.S. (Edin.), M.R.C.S. (Eng.), L.R.C.P. and D.P.H. (Lond.), County Maynar Tower, Hemel Hempstead
1880		Symons, Brenton, M.Inst.C.E., Burwood, Warminster-road, South Norwood, S.E.
1874	Trans.	‖Symons, William Henry, M.D. (Brussels), D.P.H. (Oxon.), M.R.C.S. (Eng.), F.I.C., Health Office, Guildhall, Bath
1899	Trans.	Szarvasy, Charles Emerique, Prof., Ph.D. (Buda Pesth), Müegyetem I Ker., Budapest, Hungary
1881	Trans.	‖Takamatsu, Toyokichi, Prof., Engineering College, Imperial University, Tokyo, Japan
1887	Trans.	‖Takamine, Jokichi, 550, West 173rd-street, New York City, U.S.A.
1906		Talbot, George Stanley, c/o Pacific Phosphates Co., 60A, Pitt-street, Sydney, N.S.W.
1901		Tankard, Arnold Rowsby, F.I.C., 40, Lowgate, and 12, Ferens-avenue, Cottingham-road, Hull
1909		Taplin, Edward Walter, c/o Messrs E. Lacon & Co., Ltd., The Brewery, Great Yarmouth
1909		Tapp, Charles, Cradock, Cape Colony, S. Africa
1901		Tatam, George William Gerald, 38, Clark-street, Chattanooga, Tenn., U.S.A.
1909		Tate, Arthur Edwin, M.Sc. (Dun.), Eaton Lodge, Eaton-road, Norwich
1908		Tate, Francis George Henry, Kilmersdon, Homecroft-road, Sydenham, S.E.
1890		Tate, Francis Henry, 9, Hackins Hey, Liverpool
1881	Trans.	Tate, George, Ph.D. (Würzburg), F.I.C., Windsor Buildings, George-street, Liverpool
1884		‖Tate, Walter, Woodlands, Twerton-on-Avon, Bath
1890		Tate, William, Prof., 1, Riversmeet-terrace, Topsham, Devon

ate of ection.		
367		Tatlock, Robert Rattray, F.I.C., Kilarden, Rosneath, Dumbartonshire
905		Tayleur, John William, B.Sc. (Lond.), University College, Reading
382		Taylor, Gotfred Midgley, Caxton House, Westminster, S.W.
394		Taylor, Herbert John, 52, Alexandra-crescent, Dewsbury
380		‖Taylor, James, B.Sc. (Manc.), A.R.S.M., Adderton, Dundas, N.S.W.
391		Taylor, John, 15, Lucius-street, Torquay
388		Taylor, John George, 3, Outram-street, Stockton-on-Tees
374	Trans.	‖Taylor, Robert Llewellyn, F.I.C., 4, St. Werburgh's-road, Chorlton-cum-Hardy, Manchester
901		Taylor, William Henry, B.Sc. (Lond.), F.I.C., 36, Glenhouse-road, Eltham Park, Kent
378		‖Tcherniac, Joseph, Ph.D. (Zürich), c/o South Metropolitan Gas Co., 709, Old Kent-road, S.E.
907		Tebb, William Scott, M.A., M.D. and D.P.H. (Cantab.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), L.S.A., F.I.C., Hopedale, Worple-road, Epsom
379	Trans.	‖Teed, Frank Litherland, D.Sc. (Lond.), F.I.C., 9, Mincing-lane-E.C.
906		Tempany, Harold Augustine, B.Sc. (Lond.), F.I.C., St. Johns, Antigua, British West Indies
910	Trans.	Temperley, Claude Vareille, B.Sc. (Lond.), Trent College, Derbyshire
910		Terrey, Augustus George, 47, Cann Hall-road, Leytonstone, N.E.
394		‖Terry, Edwin, 374, Brixton-road, S.W.
393		Thackrah, James Robert, M.A. (Oxon.), Ph.D. (Leipzig), Technical Schools, Tavistock-road, Plymouth
395		Theodosius, Alfred Fletcher, M.A. (Oxon.), University College, Oxford
904		Thibault, Paul John, Great Cobar Street, Cobar, N.S.W.
399		Thiersch, Harry Alexander, c/o British Resin Works, Ltd., Belvedere, Kent
910	Trans.	Thole, Ferdinand Bernard, B.Sc. (Lond.), Technical College, East Ham, E.
901		Thomas, Albert Edward, B.Sc. (Lond.), F.I.C., Boys' Middle School, Castle-street, Tiverton, Devon
908		Thomas, Frank Moreton, 106, Fenchurch-street, E.C.
907	Trans.	‖Thomas, Frederick, M.Sc. (Manc.), 29, Fairhaven-road, St. Anne's-on-the-Sea, Lancs.; and The University, Leeds
905		Thomas, George Devenish, B.Sc. (Lond.), 18, Randolph-gardens, Dover
375	Trans.	‖Thomas, Joseph William, F.I.C., Overdale, 6, Kingswood-road, Shortlands, Kent

Date of Election.			
1909			Thomas, Oswald John Dalgatty, Plant No. 2, Canada Cement Co., Ltd., Longpoint, Montreal, Canada
1877			‖Thompson, Beeby, 67, Victoria-road, Northampton
1904			Thompson, Charles Herbert, Harrington House, Amblecote, Stourbridge
1886	Trans.		‖Thompson, Claude Metford, Prof., M.A. (Cantab.), D.Sc. (Lond.), University College, and 38, Park-place, Cardiff
1894			Thompson, Edward Cumming, Froyle House, Westcombe Park-road, S.E.
1893			‖Thompson, Frank Ernest, A.R.C.S., F.I.C., 23, Lichfield-street, Walsall
1893			Thompson, George Rudd, F.I.C., The Laboratory, 69, Dock-street, Newport, Mon.
1897			Thompson, Harry, Chemical Laboratory, 5, Bishop-lane, Hull
1904			Thompson, Hubert, B.Sc. (Vict.), The Agricultural College, Potchefstroom, Transvaal, S. Africa
1886			Thompson, William Phillips, Rock Edge, Upper-park, Birkenhead
1909			Thoms, Hermann, Prof., Ph.D., Hohenzollernstrasse, 6, Steglitz, Berlin, Germany
1911	Trans.		Thomson, David, M.A. and B.Sc. (Glas.), Ph.D. (Göttingen), Cotton College, Ganhati, Assam, India
1872	Trans.	C. 1880-3, 1904-06 S. 1883-98 V.P. 1898-1901	‖Thomson, John Millar, Prof., Hon. LL.D. (Glas.), F.R.S., F.I.C., King's College, Strand, W.C.; and 18, Lansdowne-road, Notting Hill, W.
1899			Thomson, Robert Tatlock, F.I.C., 156, Bath-street, Glasgow
1872			Thomson, William, F.I.C., Royal Institution Laboratory, Manchester
1895			Thomson, William Thomas, Broom Hall, Waltham Abbey
1882	Trans.		Thorne, Leonard Temple, Ph.D. (Würzburg), F.I.C., 2, Denbigh-gardens, Richmond, Surrey
1906			Thornton, Percy Charles, Council School, Arnot-street, Walton, Liverpool
1906			Thorp, Arthur William, 210, Sherborne-road, Yeovil
1891			Thorp, Walter, B.Sc. (Lond.), F.I.C., Sorrentoville, Dalkey, Co. Dublin
1871	Trans.	C.1879-83 V.P.1884-7 T. 1889-99 P. 1899-1901	†‖Thorpe, Sir Edward, Prof., C.B., D.Sc. (Vict.), Sc.D. (Dub.), Ph.D. (Heidelberg), LL.D. (Glas.), F.R.S., Imperial College of Science and Technology, S. Kensington, S.W.
1893	Trans.		Thorpe, Jocelyn Field, D.Sc. (Manc.), Ph.D. (Heidelberg), F.R.S., The University, and 5, Endcliffe Hall-avenue, Sheffield
1899	Trans.		Threlfall, Richard, Prof., M.A. (Cantab.), Assoc. M. Inst. C.E., F.R.S., Oakhurst, Church-road, Edgbaston, Birmingham

† Longstaff Medallist, 1881.

Date of Election.			
1897	Trans.		||Tickle, Thomas, B.Sc. (Lond.), F.I.C., 83, Queen-street, Exeter
1902			Tidy, Henry Letheby, M.A., M.B., and B.Ch. (Oxon.), M.R.C.S. (Eng.), M.R.C.P. (Lond.), 103, Clarence-gate-gardens, Regent's Park, N.W.
1903			Tilburn, Charles, c/o The Australian Explosives and Chemical Co., Ltd., Deer Park, Victoria, Australia
1865	Trans.	C. 1878-81 V.P. 85-8 91-94, 96-9 T. 1899-03 P.1903-05	||Tilden, Sir William Augustus, Emeritus Prof., D.Sc. (Lond.), Hon. Sc.D. (Dub.), Hon. D.Sc. (Vict.), Hon. LL.D. (Birm.), F.R.S., F.I.C., The Oaks, Northwood, Middlesex
1900			Tilley, James Walter, 95a, Southwark-street, S.E.
1909			Tilley, Vernon James, A.I.C., Linthorpe, Becmead-avenue, Streatham, S.W.
1907			Timpany, Harold Munkman, M.Sc. (Vict.), St. Winifrede's-gardens, Shrewsbury
1904	Trans.		Tingle, Alfred, B.Sc. (Lond.), Ph.D. (Penn.), Chinanfu, Shantung, China
1889	Trans.		||Tingle, John Bishop, Prof., Ph.D. (Munich), McMaster University, Toronto, Canada
1909			Tingle, Joseph Grantley, c/o Messrs. W. Crosby & Co., 45, York-street, Sydney, N.S.W.
1907	Trans.		Tinkler, Charles Kenneth, D.Sc. (Birm.), B.Sc. (Wales), The University, Edgbaston, Birmingham
1898			Tisdale, Charles William Walker, The Dairy, Northallerton, Yorks.
1905	Trans.		Titherley, Arthur Walsh, D.Sc. (Vict. and L'pool.), Ph.D. (Heidelberg), Southcot, Manor-hill, Upton, near Birkenhead
1909	Trans.		Tizard, Henry Thomas, B.A. (Oxon.), Magdalen College, Oxford
1907			Toch, Maximilian, 52, Ninth-street, Long Island City, N.Y., U.S.A.
1891			Tocher, James Fowler, B.Sc. (Aberd.), F.I.C., 5, Chapel-street, Peterhead
1884	Trans.		||Tompson, Frederick William, The Bower, Limpsfield, Surrey
1877			||Toms, Frederick Woodland, F.I.C., Official Analyst, Jersey
1904			Tong, Walter, Holmdene, Pole-lane, Failsworth, Manchester
1904			Tonkin, Arnold Bertram, Government Laboratory, Durban, Natal, S. Africa
1906			Tonkin, Ronald William, 37, Oak-hill-road, Putney, S.W.
1907			Tonner, William Griffiths, B.Sc. (Wales), Dan-y-Bryn, Penywern-road, Neath, Glam.
1893			||Towers, John William, Victoria-road, Widnes
1888			||Townsend, Charles Frederick, The Orchard, Norton, Letchworth, Herts.

Date of Election.		
1903		Toyne, Francis Digby, M.A. (Cantab.), 51, Deeplish-road, Rochdale
1887		‖Traphagen, Frank Weiss, Prof., Ph.D. (Columbia), Colorado School of Mines, Golden, Colorado, U.S.A.
1900		Traquair, John, Glenfield Starch Works, Paisley, N.B.
1892	Trans.	Travers, Morris William, Prof., D.Sc. (Lond.), F.R.S., Indian Institute of Science, Bangalore, India; and c/o Messrs. Jeremiah Lyon and Co., 4, Lombard-court, E.C.
1906		Treble, Richard Lumley, B.Sc. (Dun.), Culham College, Culham, Oxon.
1908		Trechmann, Adolph Octavius, The Old Palace, Rochester, Kent
1895		Trehärne, Frederick Gwilym, Wrangbrook, Llanishen, near Cardiff
1888		‖Trewby, Herbert, Lampetts, Fyfield, Ongar, Essex
1881		‖Trigger, Oliver, F.I.C., Chemical Dept., Royal Arsenal, Woolwich, S.E.
1902		Trimen, Stephen Herbert, Survey Dept., Finance Ministry, Giza, Egypt
1897		Tripp, Edward Howard, Ph.D. (Marburg), The Modern School, Bedford
1905		Troye, Gustave Arthur, P.O. Box 2706, Johannesburg, S. Africa
1909		Truelove, Charles William, B.Sc. (Lond.), 23, Woodcote-road, Wanstead, N.E.
1910		Tschugaeff, Leo, Prof., The University, St. Petersburg, Russia
1905	Trans.	Tuck, William Bradshaw, D.Sc. (Lond.), University College, Gower-street, W.C.
1898	Trans.	Tucker, Samuel Auchmuty, Ph.B. (Columbia), Columbia University, New York City, U.S.A.
1896		Tuckett, James Edwin Shum, M.A. (Cantab.), Marlborough College, Marlborough
1892		Tuer, Arthur Holt, Douglas House, Worthington, Wigan
1902		Tunnicliffe, William Wright, B.Sc. (Lond.), The Herbert Strutt School, Belper
1897		Turnbull, Andrew, Ph.D. (Heidelberg), 18, Hackin's Hey, Liverpool
1906	Trans.	Turnbull, Robert Hutchison, F.I.C., c/o Messrs. MacAndrews and Forbes Co., 3rd-street and Jefferson-avenue, Camden, N.J., U.S.A.
1910		Turbutt, Richard Babington, Lieut. R.A., B.A. (Oxon.), Royal Artillery Mess, Woolwich, S.E.
1903		Turner, Arnold, 84, Molesworth-street, Rochdale
1886		Turner, Arthur, The Limes, Aylesbury
1897		Turner, Basil William, 83, Pitt-street, Sydney, N.S.W.
1888	Trans.	Turner, Charles, 225A, Oxford-street, Manchester
1906		Turner, George Augustus, 12, The Foregate, Worcester

Date of Election.			
1897			Turner, John Scriven, 20, Bury-street, Bloomsbury, W.C.
1910			Turner, Joseph, Azo House, Birkby, Huddersfield
1883	Trans.		‖Turner, Thomas, Prof., M.Sc. (Vict.), A.R.S.M., F.I.C., The University, Edgbaston, Birmingham
1903	Trans.		Turner, William Ernest Stephen, D.Sc. (Lond.), M.Sc. (Birm.), The University, Sheffield
1889	Trans.		Turpin, George Sherbrooke, M.A. (Cantab.), D.Sc. (Lond.), High School, Nottingham
1871			‖Tustin, John Robert, Albion House, The Marina, Deal
1905	Trans.		Tutin, Frank, 9, Haverfield-gardens, Kew, Surrey
1888	Trans.	C. 1909-	Tutton, Alfred Edwin Howard, M.A. and D.Sc. (Oxon.), F.R.S., 41, Ladbroke-square, W.
1892			Tweedie, Thomas Shortridge, Trensano, Annan, N.B.
1907			Twiney, William George, B.Sc. (Lond.), 106, East-street, Kingston, Jamaica
1904	Trans.		Twiss, Douglas Frank, D.Sc. (Birm.), B.Sc. (Lond.), F.I.C., The Municipal Technical School, Suffolk-street, Birmingham
1899	Trans.		Tyler, Ernest Albert, M.A. (Cantab.),33, The Promenade, Mount Pleasant, Swansea
1876			Typke, Paul George William, F.I.C., Lawn House, New Malden, Surrey
1876			Tyrer, Thomas, F.I.C., Stirling Chemical Works, Abbey-lane, Stratford, E.
1903			Tyrrell, Dennis, 182, King-street, Norwich
1908			Tyson, Thomas Marshall, 109, Carpenters-road, Stratford, E.
1865			Umney, Charles, F.I.C., 50, Southwark-street, S.E.
1893	Trans.		Umney, John Charles, 50, Southwark-street, S.E.
1889			‖Underhill, Thomas John, Stanley, Quernmore-road, Bromley, Kent
1904			Underhill, William Wood, 10, Hartham-road, Holloway, N.
1897			‖Unwalla, Rustomji Navroji, Medical Dept., Bhaunagar, Kathiawâr, India
1909	Trans.		Usher, Francis Lawry, B.Sc. (Lond.), Central College House, Bangalore, Mysore, India
1882			‖Vacher, Francis, F.R.C.S., and M.R.C.P. (Edin.), 7, Shrewsbury-road, Birkenhead
890			Valentin, Basil William, Messrs. Buckley Bros., Brewery, Llanelly, S. Wales
910			Vance, John Fleming Culun Brown, 947, Richard-street, Vancouver, British Columbia

Date of Election.			
1909			Van Essen, Everard Cecil, 54, Cannon-street, E.C.
1903			Van Laer, Norbert, c/o Messrs. Truman, Hanbury, Buxton and Co., Ltd., Burton-on-Trent
1901			Varley, Harold Fay Fleetwood, 3, Sunset-view, Ilkley
1909			Varley, Reginald Wells, c/o Leys Malleable Castings Co., Ltd., Derby
1883			Vasey, Samuel Archibald, F.I.C., Beechcroft, Burnt Ash-lane, Bromley, Kent
1894			Vaux, Cuthbert, 11, Thornhill-park, Sunderland
1879	Trans.		Veley, Victor Herbert, M.A. and D.Sc. (Oxon.), F.R.S., 8, Marlborough-place, N.W.
1891			Velling, Frederick William de, B.A. (Oxon.), Municipal Secondary School, The Boulevard, Hull
1881			Venable, Francis Preston, Ph.D. (Göttingen), Chapel Hill, North Carolina, U.S.A.
1887			||Vergara, Vargas José Maria, Apartado No. 237, Bogotá, Colombia
1911			Verschoyle, William Denham, 15, Winch-building, Vancouver, British Columbia
1901			Verteuil, Joseph de, Clarence-street, Port of Spain, Trinidad, British West Indies
1897			Viccajee, Framjee Khurshedjee, c/o Messrs. King, King & Co., P.O. Box 110, Fort, Bombay, India
1908			Vidyant, Hari Prasad, M.A. (Allahabad), C.E., Executive Engineer, Muckbulganj, Lucknow, India
1884			||Voelcker, Edward William, A.R.S.M., F.I.C., 22, Tudor-street, Blackfriars, E.C.
1884		{C.1891-5, 1902-04}	||Voelcker, John Augustus, Hon. M.A. (Cantab.), Ph.D. (Giessen), B.A. and B.Sc. (Lond.), F.I.C., 20, Upper Phillimore-gardens, Kensington, W.
1889			||Voss, Walter Arthur, Eastwood-road, Rayleigh, Essex
1885			Vulté, Hermann Theodore, Ph.D. (Columbia), Teachers' College, Columbia University, New York City, U.S.A.
1901			||Wade, Frank, A.R.C.S., F.I.C., 26, St. Ronan's-avenue, Southsea; and Laboratory, H.M. Dockyard, Portsmouth
1890	Trans.	C.1905-09	||Wade, John, D.Sc. (Lond.), F.I.C., Hunstanton Lodge, Downe, Kent; and Guy's Hospital, London Bridge, S.E.
1903	Trans.		Wadmore, John Mello, M.A. (Oxon.), Aldenham School, near Elstree, Herts.
1894			||Wagner, William George, 12, North Common-road, Ealing, W.
1893			Wait, Charles Edmund, Prof., University of Tennessee, Knoxville, U.S.A.
1888			||Wait, Frank Goodell, Geological Survey Department, Ottawa, Canada

Date of Election			
1899			Walden, Allan Frederick, M.A. (Oxon.), New College, Oxford
1897			Walford, Samuel Matthew, Wyncote, Hatherlow, Stockport
1909			Waliaschko, Nikolai Awxentiewich, Prof., University Pharmaceutical Laboratory, Sumskaja 41, Charkow, Russia
1881			‖Walker, Archibald, M.A. (Oxon.), F.I.C., Newark Castle, Ayr, N.B.
1898	Trans.		‖Walker, Andrew Jamieson, Ph.D. (Heidelberg), B.A. (Dub.), 37, Charnwood-street, and Municipal Technical College, Derby
1899			Walker, Charles, Kuranda, Waverley-street, Waverley, N.S.W.
1894	Trans.		Walker, Charles Henry Hirst, M.A. (Oxon.), 1, Victoria-terrace, Corkickle, Whitehaven
1889			Walker, Daniel, School of Mines, Ballarat, Victoria, Australia
1911			Walker, Eric Everard, 210, Bedford-hill, Balham, S.W.
1906			Walker, Franklin Wilfred, 48, Blandford-road, Bedford Park, W.
1909			Walker, George Bilderbeck, Vale House, Trafalgar-road, Greenwich, S.E.
1908			Walker, Herbert, Whyttington, Station-road, Wealdstone, N.W.
1890	Trans.	C 1899-04 V.P. 1909-	‖Walker, James, Prof., D.Sc. (Edin.), Ph.D. (Leipzig), Hon. LL.D. (St. Andrews), F.R.S., The University, and 5, Wester Coates-road, Edinburgh
1890			Walker, James Samuel Hourston, M.B. and C.M., (Edin.), D.P.H. (Cantab.), Clinical Research Association, Watergate House, Adelphi, W.C.
1897	Trans.		Walker, James Wallace, Prof., M.A. (St. Andrew's), Ph.D. (Leipzig), McGill University, Montreal, Canada
1888			Walker, John Thom Ainslie, Belmar, Kew Gardens, Surrey
1903			Walker-Pole, Miles, 71, De Korle-street, Braamfontein, Johannesburg, S. Africa
1905			Wall, Francis Henry, 1, Part-street, Southport
1884			‖Wallace, Robert, Prof., The University, Edinburgh
1878			‖Waller, Elwyn, A.M. (Harvard), Ph.D. (Columbia), 7, Franklin-place, Morristown, N.J., U.S.A.
1904			Walling, Léon Edward, 16, Beechhill-road, Eltham, Kent
1910			Wallis, Robert Lauder Mackenzie, B.A. (Oxon.), Llyndu, Cardiff-road, Llanishen, Cardiff
1902			‖Wallis, Thomas Edward, B.Sc. (Lond.), F.I.C., 96, Stephens-road, Tunbridge Wells, Kent
1883			‖Walmsley, Robert Mullineux, D.Sc. (Lond.), Northampton Institute, St. John-street, Clerkenwell, E.C. ; and 23, Hilldrop-road, Camden-road, N.
1905	Trans.		Walpole, George Stanley, D.Sc. (Melbourne), F.I.C., The Wellcome Physiological Research Laboratories, Brockwell Hall, Herne Hill, S.E.

Date of Election.			
1888			Walrond, Edward Dalrymple, M.A. (Cantab.), North Eastern County School, Barnard Castle, Durham
1903			Walsh, Thomas Crosbie, c/o Messrs. Rogers & Walsh, Casilla 1118, Buenos Ayres, Argentine, S. America
1899			Walton, Robert Hawks, Flinders, Martin's-avenue, Bondi, Sydney, N.S.W.
1908			Walton, Sidney Gilbert, Kensington, Northwood-road, Northwood, Lane Cove River, N.S.W.
1884			‖Walton, Thomas Utrick, B.Sc. (Glas.), F.I.C., Colonial Sugar Refining Co., Sydney, N.S.W.
1911			Walton, William Keighley, Beechwood, Upper Rushton-road, Thornbury, Bradford
1905			Want, William Phillip, 11, Pearfield-road, Forest Hill, S.E.
1864			Ward, George, F.I.C., Buckingham-terrace, Headingley, Leeds
1908			Ward, Herbert Horace, University College of Wales, Aberystwyth
1910			Ward, Percy George, B.Sc. (Lond.), A.R.C.S., 66, Radipole-road, Fulham, S.W.
1891			‖Ward, Thomas Armistead, 15, Exchange-street, Blackburn
1907			Warner, Charles Horne, B.Sc. (Lond.), A.I.C., The Pharmaceutical Society, 17, Bloomsbury-square, W.C.
1871			Warner, George Joseph, Halton Villa, Widnes
1906			Warren, Richard Alfred, Belle Vue, Hallow-road, Worcester
1888			Warrick, Frederic Walmsley, 6, Nile-street, City-road, N.
1895			Warrington, Thomas Cotterill, M.A. (Oxon.), 29, Stockwell-street, Leek, Staffs.
1909			Warwick, Guy Ransom, M.A. (Cantab.), c/o The Bombay British Beer Brewery Co., Ltd., The Brewery, Gobra-road, Entally, Calcutta, India
1906			Wasteneys, Hardolph, The Rockefeller Institute for Medical Research, 66th-street and Avenue A, New York City, U.S.A.
1882			Waterfall, Charles James, F.I.C., 4, Queen-square, Bristol
1901			‖Waterhouse, James, Major-General, I.S.C., Hurstmead, High-street, Eltham, Kent
1907			Watkins, Charles Rowlatt, B.A. (Cantab.), Imperial Customs Service, Custom House, Bombay, India.
1908			Watkins, Edwin John, 561–563, Bourke-street, Melbourne, Australia
1885			‖Watson, Charles, Fairfield, Washwood Heath-road, Birmingham
1904	Trans.		Watson, Edwin Roy, Prof. M.A. (Cantab.), B.Sc. (Lond.), Dacca College, Dacca, Eastern Bengal, India
1887			‖Watson, Frederick Percy, 6 and 7, Bailgate, Lincoln
1899			Watson, Fred. Sheasby, B.Sc. (Vict.), Sandgate, Villiers-road, Woodthorpe, Nottingham

Date of Election.		
1906		Watson, Frederick William, B.Sc. (Lond.), F.I.C., Consolidated Gold Fields of South Africa, Ltd., P.O. Box 108, Germiston, Transvaal, S. Africa
1907		Watson, George Arthur, A.R.C.S.I., Clongowes Wood College, Sallins, Co. Kildare, Ireland
1911		Watson, Henry Hough, Braystones, Carnforth
1908	Trans.	Watson, Herbert Edmeston, B.Sc. (Lond.), A.I.C., The Cavendish Laboratory, Cambridge
1904		Watson, Herbert Wood, B.Sc. (Vict.), Rose Villa, Roper-avenue, Gledhow, Leeds
1908		Watson, John, B.Sc. (Dun.), 5, Kendrew-street, Darlington
1906		Watson, John Adam, 8, Powis-gardens, Notting Hill, W.
1883		‖Watson, Thomas Donald, 16, St. Mary's-road, Bayswater, W.
1876	Trans.	‖Watson, William Henry, J.P., Braystones House, Beckermet, Cumberland
1877		Watt, Alexander, F.I.C., c/o Messrs. Macfie and Sons, 34, Moorfields, Liverpool
1904		Watt, Francis Langston, A.R.C.S., F.I.C., Russenden, Stanley-street, Epping, near Sydney, N.S.W.
1906		Watt, George Gordon, 42, Valley-road, Streatham Hill, S.W.
1906	Trans.	Watt, Henry Edgar, D.Sc. (Dun.), F.I.C., Blandfield Chemical Works, Wheatfield-road, Edinburgh
1908		Watt, John, Rev., M.A. (Aberd.), 2, Cornwallis-Square, Calcutta, India
1908		Watt, Robert Dickie, Prof., M.A. and B.Sc. (Glas.), The University, Sydney, N.S.W.
1883	Trans.	Watts, Francis, C.M.G., D.Sc. (Birm.), F.I.C., Imperial Commissioner of Agriculture for the West Indies, Barbados, West Indies
1872	Trans.	‖Watts, John, M.A. (Oxon.), D.Sc. (Lond.), F.I.C., Merton College, Oxford
1878	Trans.	Watts, John Isaac, Beechfield, Hartford, Cheshire
1888		Way, Edward John, F.I.C., M.Inst.C.E., M.I.M.E., c/o Anglo, French Exploration Co., P.O. Box 2927, Johannesburg, S. Africa
1911		Waygood, Bertie James, 39, Marshall-road, Levenshulme, Manchester
1901		Wayland, William Abraham, 12, Albert-road, St. John's, S.E.
1883	Trans.	Webster, Charles Stuart Stanford, F.I.C., Malvern House, Redland, Bristol
1909		Webster, John, F.I.C., Laboratory of Pathological Chemistry, St. Mary's Hospital, Paddington, W.
1906	Trans.	Wechsler, Elkan, Ph.D. (Würzburg), 59, Petherton road, Canonbury, N.

Date of Election.		
1907		Wechsler, Marcus, D.Sc. (Grenoble), 136, Sinclair-road, Kensington, W.
1904		Weeks, Henry Bridges, F.I.C., The Retreat, Infield-park, Barrow-in-Furness
1908		Weighell, Arthur, Top Floor, Prince-building, Medows-street, Fort, Bombay, India
1905		Weiskopf, Eric Hartwig, Ph.D. (Toulouse), c/o Japanese Explosives Co., Ltd., Hiratsuka, Japan
1903		Weiss, Carl Friederich Richard, M.A. and Ph.D., (Bâle), 23, Cloth Fair, E.C.
1898		Weissmüller, Edward Charles, Hill Crest, The Heath, Runcorn
1909	Trans.	Weizmann, Charles, D.Sc. (Manc.), Ph.D. (Freiburg), 57, Birchfields-road, Rusholme, Manchester
1901		Welch, George Edward, B.Sc. (Lond.), Grammar School, Wakefield
1893		Welchman, Frank Ernest, 16, Carlton-road, Putney Hill, S.W.
1891		Wellington, Stephen Newcombe, Assoc.M.I.E.E., c/o Coke Ovens and By-Products Co., Ltd., 181, St. Stephen's House, Westminster, S.W.
1884	Trans.	Wells, James Simpson Chester, Ph.D. (Columbia), Cañon City, Col., U.S.A.
1890		Wells, Sydney Russell, M.D. and B.Sc. (Lond.), M.R.C.S. (Eng.), M.R.C.P. (Lond.), 16, Lower Seymour-street, Portman-square, W.
1903		Welsford, Giles Haddon, Royal Gunpowder Factory, Waltham Abbey, Essex
1897		Welsh, John, M.R.C.S. (Eng.), L.R.C.P. (Lond.), 43, Tarvin-road, Chester
1888	Trans.	Werner, Emil Alphonse, F.I.C., 1, Fairfield-park, Highfield-road, Rathgar, Dublin
1886		‖Wertheimer, Julius, Prof., B.A. and B.Sc. (Lond.), F.I.C., Merchant Venturers' Technical College, Bristol
1902		West, Joseph, Beechwood, The Avenue, Kidsgrove, Stoke-on-Trent
1909		West, Percy Charles Henry, 12, Goldington-crescent, Crowndale-road, N.W.
1898		Weston, Frank Edwin, 43, Larkhall-rise, Clapham, S.W.
1892		Whalley, Lawrence John de, 18, Brandram-road, Lee, S.E.
1893		Whalley, Sidney, B.Sc. (Lond.), 18, Nevilledale-terrace, Durham
1908		Wheatley, William, B.A. (Oxon.), 13, St. Silas'-road, Blackburn
1906		Wheaton, Harold Joseph, 21, Chesterton-road, Cambridge
1907	Proc.	Wheeler, Edward, A.C.G.I., c/o Messrs. S. Courtauld & Co., Ltd., Foleshill-road, Coventry

Date of Election.		
1902		Wheeler, Edward Jonathan, Ph.D., 79, Chapel-street, Albany, N.Y., U.S.A.
1905		Wheeler, Ernest, c/o Messrs. Crossley Bros., Openshaw, Manchester
1894		Wheeler, Henry Lord, Ph.D. (Yale), The Sheffield Laboratory, New Haven, Conn., U.S.A.
1909	Trans.	Wheeler, Richard Vernon, D.Sc. (Manc.), Colliery House, Altofts, Normanton
1893		‖ Wheeler, William Ernest, 33, Haverstock-road, Knowle, Bristol
1897		Wheelwright, Edwin Whitfield, B.A. (Oxon.), Ph.D. (Munich), F.I.C., Greenholme, 24, Stanmore-road, Edgbaston, Birmingham
1911		Wheldon, Alfred Henry Finniss-, 446, Currie-road, Durban, Natal, S. Africa
1897		While, Arthur James, Glen Garth, Barrow-in-Furness
1879		Whitaker, Thorp, Bradford Dyers' Association, Ltd., Bradford
1891		White, Henry, 245, Western-road, Crookes, Sheffield
1893		White, Henry Clay, Prof., Ph.D. (Virginia), Hon. D.C.L. (Univ. South), Hon. LL.D. (Illinois), University, Athens, Georgia, U.S.A.
1899		White, Henry Fox, 52, Royal York-crescent, Clifton, Bristol
1905		White, John Ledger, D.Sc. (Dun.), 9, Sugden-road, Lavender Hill, S.W.; and Battersea Polytechnic, Battersea Park-road, S.W.
1905		White, John William, B.Sc. (Lond.), c/o The E.C. Powder Co., Green Street Green, Dartford
1897		White, Paul Thomas, Hortonfield House, West Drayton, Middlesex
1902		White, William Carter, Glenholme, Longlands-park-road, Sidcup, Kent
1893		‖ White, William Gilchrist, Vicarage View, 133, Tottington-road, Bury, Lancs.
1885		Whitehead, Henry Hammond, 18, Boston-road, Brentford
1896		Whitehead, James, 8, West-street, Rochdale
1901		Whitehouse, Philip Lewington, c/o Messrs. W. H. Keys, Ltd., Hall End Works, West Bromwich
1889		‖ Whitehouse, William, Albany House, Bradmore, Wolverhampton
1904	Trans.	Whiteley, Charles Edward, 21, Brudenell-view, Leeds
1886	Proc.	‖ Whiteley, Richard Lloyd, F.I.C., Municipal Science and Technical School, West Bromwich
1892		Whiteside, John Lowe, 376, St. Helen's-road, Bolton
1863		‖ Whitfield, John, 113, Westborough, Scarborough
1899		Whittaker, Christopher Joseph, c/o United Indigo and Chemical Co., Ltd., 1, Cooper-street, Manchester

Date of Election.		
1889		Whittam, Matthew, M.A. (Cantab.), 75, Creffield-road, West Acton, W.
1901		Whittle, James, 30, Bridge-street, Morpeth
1907		Whymper, Robert, A.C.G.I., St. Clare, St. Mary's-road, Ditton Hill, Surrey
1906		Wiffen, Henry John, 17, Albany-road, Manor-park, E.
1889		Wigan, Basil Penwarne, Rhondda Valley Brewery Co., Treherbert, Pontypridd
1905		Wigginton, John Henry Becker, 2, Kitson-road, Barnes, S.W.
1907		Wight, Robert Burt, M.A. (Cantab.), 5, Phillips-avenue, Linthorpe, Middlesbrough
1906		Wightman, Charles, 36, Curzon-street, W.
1896	Proc.	Wigner, John Harrison, Ph.D. (Heidelberg), c/o Messrs. W. Gossage & Sons, Ltd., Soap Works, Widnes
1896		Wilcox, Alfred James, Rev., The Vicarage, Maiden Bradley, Bath
1891		‖Wild, John, B.Sc. (Vict.), A.I.C., Bredbury House, Bredbury, Stockport
1909		Wild, Thomas Jabez, 204, Peckham Rye, S.E.
1898		‖Wild, William Ernest, B.Sc. (Vict.), 105, Shaw-lane, Dinting, near Glossop
1898		Wilder, Frederick Louis, Mining and Metallurgical Club, 3, London-wall-buildings, E.C.
1897	Trans.	Wilderman, Meyer, Ph.D. (Freiburg), B.Sc. (Oxon.), Davy-Faraday Research Laboratory, Albemarle-street, W.
1902	Trans.	Wilkinson, Edward John, 24, Bertram-road, Manningham, Bradford
1904		Wilkinson, James Alfred, M.A. (Cantab.), Transvaal University College, P.O. Box 1176, Johannesburg, S. Africa
1903		Wilkinson, James Bates, M.D. and C.M. (Edin.), D.P.H. (Vict.), Town Hall, Oldham
1893		Wilkinson, John, Corporation Gas Works, Halifax
1905		Wilkinson, John Wells, M.A. (Wales and Bristol), Longhope, Essendene-road, Belvedere, Kent
1911	Trans.	Wilks, William Arthur Reginald, M.A. (Cantab.), Caius College, Cambridge
1891		Will, Wilhelm, Prof., Ph.D. (Berlin), Colonie Grunewald, Boothstrasse 32, bei Berlin, Germany
1904	Proc.	Willcox, William Henry, M.D., B.Sc., M.R.C.P. and L.S.A. (Lond.), D.P.H. (Eng.), F.I.C., St. Mary's Hospital, Paddington, W.
1906		Willett, Herbert William Mills, 30, Ashburton-place, S. Kensington, S.W.
1905		Williams, Alan Herbert, Brockweir, Urmston, Manchester
1910		Williams, Arthur Bernard, Bradley-court, Mitcheldean, Glos.

ate of lection.		
903		Williams, David John, Bath and West of England College of Chemistry and Pharmacy, 6, Cleveland-place, East Bath
908		Williams, David Thomas, 42, Finsbury-square, E.C.
895		Williams, Evan, Bradford-road Gas Works, Manchester
908		Williams, Frederick, B.A. (Oxon.), Bute Villa, Aberdare, S. Wales
910		Williams, Frederick George, 5, Mayhill-road, Charlton, Kent
909		Williams, Herbert Ernest, 23, Kenilworth-road, Beckenham-road, Penge, S.E.
910		Williams, Herbert Goulding, B.Sc. (Lond.), Robert Gordon's College, Aberdeen
892		Williams, John, Government Laboratory, British Guiana
910		Williams, John, B.Sc. (Lond. and N. Z.), 122, Liddell-street, Invercargill, New Zealand
908		Williams, Joseph Henry, 43, Prince's-road, Wimbledon, S.W.
907	Proc.	Williams, Percy, B.Sc. (Lond.), 4, Ferrow-road, Lower Clapton, N.E.
883	Proc.	Williams, Rowland, F.I.C., Hale Cote, Albert-park, Lancaster
891		Williams, Seward Whiting, c/o Messrs. Bauer and Black, 25th and Deaborn-streets, Chicago, Ill., U.S.A.
872		‖Williams, Thomas, Chemical Laboratory and Assay Office, 8, Victoria-street, Liverpool
885	Trans.	‖Williams, Walter Collingwood, B.Sc. (Lond.), F.I.C., Public Analysts Laboratory, 36, Dansic-street, Liverpool
899	Proc.	Williams, William Arthur, 19, Craylockhart-terrace, Edinburgh
874	Trans.	‖Williams, William Carleton, B.Sc. (Vict.), F.I.C., Broomgrove, Goring-on-Thames, Reading
898		Williamson, John Alexander, The Croft, Chase Court-gardens, Enfield, Middlesex
874	Trans.	‖Williamson, Robert, F.I.C., Messrs. Williamson and Corder, Ltd., Walker, Newcastle-on-Tyne
886	Trans.	Williamson, Sidney, Ph.D. (Munich), F.I.C., c/o The Cooper Research Laboratory, Berkhamsted, Herts.
898		Williamson, William, 94, Hainault-road, Leytonstone, N.E.
907		Willott, David, B.Sc. (Lond.), Nutcombe, Cumnor-road, Sutton, Surrey
896		‖Wills, Sir Edward Chaning, Bart., M.A. (Cantab.), Harcombe, Chudleigh, Devon
09		Wills, Harry Sampson, 9, Salehurst-road, Crofton-park, S.E.
72		Wills, Joseph Lainson, 133, Midwood-street, Flatbush, Brooklyn, N.Y., U.S.A.
06		Willstaetter, Richard, Prof., Ph.D. (Munich), Bergstrasse 25, Zürich V, Switzerland

Date of Election		
1892	Trans.	Wilsmore, Norman Thomas Mortimer, D.Sc. (Melbourne), 12 Walm-lane, Willesden Green, N.W.
1885		Wilson, Alfred Charles, F.R.S.E., Borough Hall, Stockton-on-Te
1879		‖Wilson, Charles Joseph, F.I.C., 14, Suffolk-street, Pall Mall-eas S.W.
1894		Wilson, Christopher, The Grammar School, Manchester
1883	Trans	‖Wilson, David, M.A. and D.Sc. (Glas.), Carbeth, Killearn, Glasgo
1901		‖Wilson, Duncan Randolph, 44, Whitehall-court, S.W.
1899	Proc.	Wilson, Frederick Robert Leyland, M.A. (Oxon.), Charterhous Godalming
1908		Wilson, Harry Percy, 3, Audley-road, Colchester
1875		‖Wilson, James, M.A. (Dub.), Barrister-at-Law, 2, Essex-cour Temple, E.C. ; and 121, Claremont-road, Forest Gate, Essex
1890		Wilson, James Mitchell, M.D. and C.M. (Glas.), D.P.H (Cantab.), County Hall, Beverley
1895	Proc.	Wilson, John, M.Sc. (Vict.), F.I.C., Battersea Polytechnic, S.W
1902		Wilson, Lyndon Charles, 31, Castle-gate, Newark-on-Trent
1900	Proc.	Wilson, Leonard Philip, 8, Chester-street, Coventry
1909	Trans.	Wilson, Robert William, 120, Wanstead-park-avenue, Wanstead N.E.
1871		‖Wilson, William John, c/o Dr. W. M. Watts, Shirley, Venne road, Sydenham, S.E.
1907		Wilson, William John, A.C.G.I., 12, Vicarage-park, Plumstead Kent
1884		Wilton, Thomas, The Gas Light and Coke Co., Beckton, Nort Woolwich, S.E.
1893		Winder, Edward Humphreys, Felton, Ludlow
1894		Wingate, Hamilton More, B.Sc. (Glas. and Melbourne), 71 Queenswood-road, Forest Hill, S.E.
1895		Wingfield, Thomas Rowland, 5, Bromwich-street, Bolton
1911		Wink, Ian Gordon Sellars, 27, Panmuir-road, Cottenham-park Wimbledon, S.W.
1876		Winser, Percy James, F.I.C., Heath House, Knutsford
1908	Trans.	Winterson, William George, B.Sc. (Lond.), 89, Salisbury-road Barnet
1906		Winther, Christian, Ph.D. (Copenhagen), Ostervold 5, Copenhagen, Denmark
1898	Trans.	Witham, Ernest, B.A. and B.Sc. (Lond.), The Grammar School Rotherham
1908		Withey, William Henry, B.A. (Cantab.), Walpole House, Church-road, Teddington, Middlesex
1876	Trans.	‖Witt, Otto Nikolaus, Geh. Rath Prof., Dr., Ebereschenallee 10, Westend bei Berlin, Germany

Date of Election.		
1906		Wolfe, Ernest Edwin, Kinsale, Co. Cork, Ireland
1910		Wolfenden, Stuart Jardine Norris, The Conservative Club, St. James'-street, S.W.
1907		Wolff, Mark Arthur, 6, Hanover-terrace, Holland-park, W.
1902		Womersley, Charles Edward, 7, Tidswell-street, Heckmondwike, Yorks.
1889		Wood, Charles, Rossemount, Emm-lane, Heaton, Bradford
1860	Trans.	‖Wood, Charles Henry, F.I.C., Erica, Bournemouth-road, Parkstone, Dorset
1911		Wood, Edward Estcott, Hurricane House, Brymbo, Wrexham
1908		Wood, Francis Charles Benjamin, Deurne, near Antwerp, Belgium
902		Wood, Frank Stanley, Chin Chu, Heathcote-street, Newland, Hull
898	Trans.	Wood, Thomas Barlow, Prof., M.A. (Cantab.), School of Agriculture, Cambridge
911		Wood, William, c/o Messrs. Burroughs, Wellcome and Co., Waterloo, N.S.W., Australia
903		‖Wood, William Francis John, B.Sc. (Lond.), Osborne House Barnsley
900		Woodbridge, Walter Bourne, A.C.G.I., c/o A. E. Woodbridge, Esq., The Steyne, Bognor
871	Trans.	Woodcock, Reginald C., F.I.C., The Sanitas Co., Ltd., Locksley-street, Limehouse, E.
904		Woodcock, William Henry, Craigfernie, Felbrigge-road, Goodmayes, Essex.
898		Woodhead, Samuel Allinson, B.Sc. (Dun.), F.I.C., Agricultural College, Uckfield, Sussex
909		Woods, George James, 2, Wellmeadow-road, Lewisham, S.E.
892		‖Woods, Hugh, B.A., M.D. and B.Ch. (Dub.), D.P.H., (R.C.P.S.I.), Red House, Bordyke, Tonbridge
888		Woodward, James, B.A. and B.Sc. (Lond.), F.I.C., Drummond House, 31, Coventry-road, Ilford, Essex
889		Woolf, Mortimer, Mayfield, Mortimer-road, N.W.
903		Woolhouse, Sidney Herbert, M.A. and B.Sc. (Dub.), A.R.C.S.I., Eastleigh, Latymer-road, Lower Edmonton, N.
889		Woosnam, Richard William, F.I.C., 1, The Chase, Warby Mount, Brentwood, Essex
908	Trans.	Wootton, Hubert Arthur, M.A. (Cantab.), B.Sc. (Lond.), 20, Great College-street, Westminster, S.W.
908	Trans.	Wootton, William Ord, B.Sc. (Lond.), A.R.C.S., Chemical Department, St. Bartholomew's Hospital and College, E.C.
903		Worden, Edward Chancey, M.A. (N.Y.), Clark Thread Co. Newark, N.J., U.S.A.
908	Trans.	Worley, Frederick Palliser, M.A. and M.Sc. (N.Z.), Mansfield House, Clifton-gardens, Maida Hill, W.

Date of Election.			
1884			‖Worrall, Jason Hall, F.I.C., Howsley, Chapeltown, near Sheffield
1858			‖Worsley, Philip John, Rodney Lodge, Clifton, Bristol
1906			Wortley, Edward Jocelyn, Rectory, Half-way-tree, Jamaica
1906	Trans.		Wren, Henry, M.A. (Oxon.), D.Sc. (Lond.), Ph.D. (Tübingen), Municipal Technical Institute, Belfast
1905			Wren, William James, A.R.C.S., Hilton College, near Maritzburg, Natal, S. Africa
1898			Wrench, Charles Arthur, 95A, Southwark-street, S.E.
1908			Wright, Allister MacLean, P.O. Box 617, Christchurch, New Zealand
1908			Wright, Charles Harold, B.A. (Cantab.), F.I.C., Government Laboratory, Port of Spain, Trinidad, British West Indies
1895			Wright, Harold Edward, c/o Sir B. Samuelson and Co., Ltd., Middlesbrough
1909			Wright, Joseph Pretty, 883, Burrard-street, Vancouver, B. Columbia
1894			Wright, Robert, 5, Devonshire-colonnade, Buxton
1911	Trans.		Wright, Robert, M.A. (R.U.I.), Lauriston, Derrysolgie-avenue, Belfast
1910			Wright, William Norman Stewart, 26, Lansdowne-crescent, Glasgow, W.
1886	Trans.		‖Wright, William Thomas, 11, Rundle-road, Sheffield
1864			‖Wrightson, John, Prof., Charford, Manor House, Downton, Salisbury
1880			Wyborn, John Middleton, Shoulden, Farnaby-road, Bromley, Kent
1884			‖Wyley, William Fitzthomas, Wheatley-street, Coventry
1885	Trans.	C. 1892-6, S. 1898-99, 1903-05, V.-P 1905-08.	‖Wynne, William Palmer, Prof., D.Sc. (Lond.), F.R.S., F.I.C., A.R.C.S., The University, and 17, Taptonville-road, Sheffield
1911			Yates, Charles Fursdon, Ronaldene, Witham-road, Isleworth
1908			‖Yates, Harry James, M.I.M.E., Redcroft, Four Oaks, Warwickshire
1908	Trans.		Yates, Joseph, M.Sc. (Manc.), B.Sc. (Lond.), F.I.C., Municipal Technical School, Blackburn
1886	Trans.		Yoshida, Hikorokurō, Prof., Imperial University of Kyoto, Kyoto, Japan
1885			Young, Alfred Collett, 17, Vicar's-hill, Lewisham, S.E.
1903			Young, Andrew, M.A. and B.Sc. (Edin.), Geological Department, South African College, and 5, Rosmead-avenue, Cape Town, S. Africa
1886			‖Young, Brougham, Clarence House, 4 and 8, Arthur-street-west, E.C.

ate of lection.			
908	Trans.		Young, Charles Robert, B.Sc. (Lond.), 11, Low-pavement, Nottingham
897			Young, Francis Samuel, M.A. (Oxon.), F.I.C., The College, Bishop's Stortford
877			‖Young, Frank Watson, F.R.S.E., 32, Buckingham-terrace, Botanic-gardens, Glasgow
890	Trans.		‖Young, George, Ph.D. (Erlangen), F.I.C., Bradda, Church-crescent, Church-end, Finchley, N.
895			Young, Henry Stow, F.I.C., c/o The Borneo Co., Ltd., Kuching, Sarawak
894			Young, James, 12, Edge-hill, Plumstead, Kent
874			Young, John, 164, Bath-street, Glasgow
910			Young, John, A.I.C., 95, Finlay-drive, Dennistoun, Glasgow
898			Young, John Henry, B.Sc. (Vict.), c/o Cassel Gold Extracting Co., Ruehill-road, Maryhill, Glasgow
877			‖Young, John Rymer, 21, Palmyra-square, Warrington
909			Young, Roland Francis, c/o Tarkwa Trading Co., Tarkwa, Gold Coast, W. Africa
882	Trans.	C. 1894-8.	‖Young, Sydney, Prof., D.Sc. (Lond.), B.Sc. (Manc.), Hon. Sc.D. (Dub.), F.R.S., F.I.C., Trinity College, Dublin
873			‖Young, William Charles, F.I.C., 2, Queen Anne's-grove, Bedford Park, W.; and Chemical Laboratory, 24, Aldgate, E.
910			Yusuf, Syed Muhammad, B.Sc. Tech. (Manc.), School of Technology, Whitworth-street, Manchester
907	Trans.		Zortman, Israel Hyman, B.Sc. (Vict.), Ph.D. (Leipzig), 13, Skinner-lane, Leeds

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